SERVICE TO AIR CONDITIONING INDUSTRY

CAREYDUCT

AND SPECIFICATIONS FOR

CAREYDUCT • METAL DUCT INSULATION • PIPING INSULATION • EQUIPMENT HOUSING PANELS

A. I. A. FILE No. 30-D-4

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Careyduct
ASBESTOS INSULATED DUCT

THE PHILIP CAREY COMPANY
GENERAL OFFICES • LOCKLAND • CINCINNATI, OHIO
BRANCHES IN ALL PRINCIPAL CITIES

44 GOOD REASONS

FOR PREFERRING Careyduct MADE OF ASBESTOS

1 CAREYDUCT COMPRISES BOTH DUCT AND INSULATION

Duct and insulation are erected in one and the same operation.

2 NATURAL SOUND ABSORBER

The interior surface has a natural tendency to absorb sound.

3 NON-CONDUCTOR OF SOUND

Its physical characteristics are such that sound is not readily conducted thru it.

4 NON-RESONATING

"Hushes" fan noises — cuts down speaking tube effects.

5 EASY TO ERECT

Simple slip-joint construction.

6 HIGH VELOCITY ADVANTAGE

Not limited because of noise, cuts cost, increases efficiency.

7 SIMPLICITY OF FITTINGS

All fittings made on the job, simply, quickly, easily and economically.

8 NO LEAKAGE

Two layer staggered joint construction, with all joints sealed—stops all leaks, affecting a saving in power and volume of air.

9 FIREPROOF

Built of Asbestos—will not smoulder or burn.

10 LOW FRICTION

Smooth surface, flush joints, turns in fittings reduce friction below that of best metal construction.

11 CLEAN APPEARANCE

Smooth surfaces—no unsightly raised seams or joints—trim straight lines.

12 PERMANENT

No rust, no decay—made of everlasting Asbestos.

13 NO NOISE IN ERECTION

No need for banging, and disturbing occupants; can be installed while the premises are occupied without objectionable interference.

14 ALL JOINTS OVERLAPPED

Principle of erection used (telescoping sections) insures overlapping of joints, eliminates leaks.

15 DUCTS CAN BE BANKED

Unique method of erection permits parallel runs to be banked side by side.

16 INSULATED

Factory made insulated units insure uniform high efficiency in entire system.

17 NO FURRING NEEDED

Presents a base surface for paints and other types of decorative finishes.

18 HARMONY WITH ARCHITECTURE

Blends well because of smooth trim appearance with architectural features.

19 WILL RECEIVE PLASTER

Capable of withstanding water incident to plastering, presents a fine base for plaster.

20 LIGHT IN WEIGHT

In ½ inch thickness duct and insulation weighs only 2 lbs. per sq. ft.

21 **NO UNSIGHTLY RAISED SURFACES**

No crimping ridges—no stiffening marks.

22 **LOW ERECTION COST**

Job-made fittings eliminate shop overhead (see data page 34 for time requirements).

23 **STURDY**

Strong and rigid—will support a man.

24 **INVISIBLE SUPPORTS**

Possible to erect in exposed spaces with no visible means of support.

25 **ALL FITTINGS EFFICIENT**

By the use of turning vanes, and slip joint construction, efficiency of all fittings is maintained.

26 **LOW COST OF FITTINGS**

Job-built fittings are inexpensive (see data).

27 **VERMIN PROOF**

Is not attacked by vermin—fungi, insects, etc.

28 **EFFECT OF WATER**

Can be subjected to soaking—upon complete drying returns to original condition.

29 **ADAPTABLE TO HEATING OR COOLING**

Performs equally well under either condition—delivers conditioned air to required location.

30 **ALL WORK DONE ON JOB**

Eliminates shop overhead, draying charges on fittings—it is possible to do all work on location.

31 **ADAPTABLE TO STANDARD GRILLES AND DAMPERS**

No special grilles and dampers required—takes any standard make.

32 **NON-CONDUCTOR OF ELECTRICITY**

Does not readily conduct electricity (made of an insulator).

33 **SMALL SIZE ADAPTABLE TO SPACE REQUIREMENTS**

Smaller sizes made possible by the Careyduct system allow more head room—greater adaptability.

34 **NO UNSIGHTLY STIFFENERS**

The stiff rigid construction of Careyduct entirely eliminates the need for unsightly angle iron stiffeners.

35 **DOES NOT VIBRATE OR BREATHE**

High velocities do not cause vibration and breathing.

36 **NO SPECIAL TOOLS REQUIRED FOR CONSTRUCTION OR ERECTION**

Common hand tools are all that are required to construct fittings, and erect Careyduct.

37 **NO DUST STREAKING ON CONCEALED WORK**

No common discoloration of plaster.

38 **NO LEAKAGE AT INACCESSABLE CONCEALED JOINTS**

The slip joint construction of Careyduct prevents leaks in any part of the system.

39 **NO WARPING OF ADJACENT CONSTRUCTION MEMBERS**

Careyduct being insulated has no detrimental effect on construction members.

40 **DUCTS CAN BE RUN IN AND DISTRIBUTION AFFECTED FROM OUTSIDE WALLS**

This method eliminates cutting of internal construction members, and permits location of supply outlets without interfering with furniture placement or door swings.

41 **ELIMINATES CANVAS CONNECTORS ON PLENUM CHAMBER**

No vibration or noise travel to worry about.

42 **DIRT AND DUST HAVE NO EFFECT ON RATE OF HEAT LOSS**

The insulating efficiency of Careyduct is not changed because of change in surface conditions.

43 **TOTAL WEIGHT DECREASED**

Increased velocities result in smaller ducts, hence lighter total load on supporting structure.

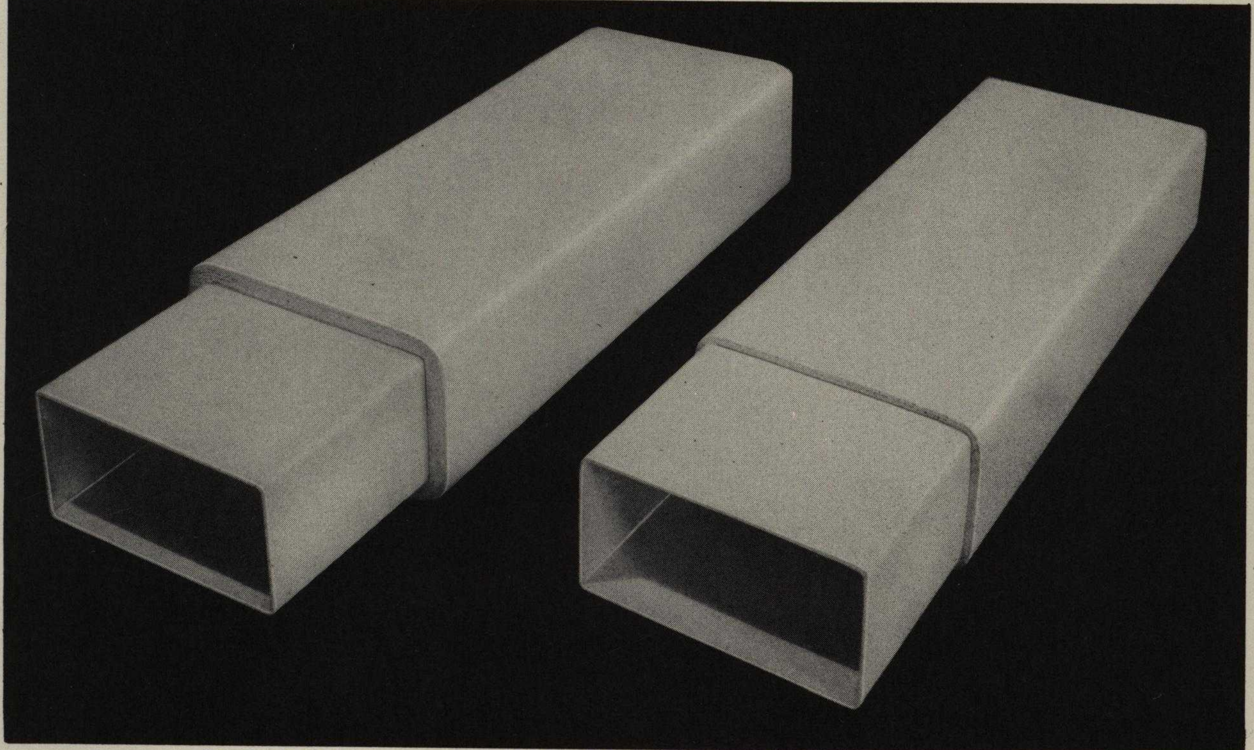
44 **NESTING POSSIBLE**

It is possible with Careyduct to nest any desired combination.

PREFACE

Notable improvements have been made in heat and cold producing units, in controls, and in grilles for diffusing conditioned air, but until the advent of Careyduct no marked improvement has been made in the conveying conduit. The advantages in uniformity, cost and efficiency of standardized factory built *insulated* duct units should be obvious. Careyduct now rounds out and completes the modern air conditioning system.

CONSTRUCTION OF CAREYDUCT



One inch thick and one-half inch thick Careyduct sections with cores extended.

Careyduct is made in standard double layer sections three feet long. The section consists of an inner layer or core which is approximately $\frac{3}{16}$" thick of solid, firm, asbestos structure. This gives the mechanical strength or "backbone" to the duct. Over this core and making a close sliding fit is an outer shell or insulating jacket made of multiple layers of fine corrugated asbestos firmly bonded to form a substantial structure and give high insulating value. The total wall thickness of core and jacket combined can be made from ½" up to suit conditions.

CONSTRUCTION OF CAREYDUCT

Careyduct is finished in smooth, natural white asbestos. This surface is readily adaptable to any added decorative finish. The outside surface of the insulating jacket has been hardened as a protective measure against damage during erection and when in service.

Careyduct is recommended in the following thicknesses:

For residential winter air conditioning, total wall thickness to be ½ inch.

For residential and commercial winter and summer air conditioning, total wall thickness not less than 1″. This thickness will prevent, by a wide margin of safety, surface condensation for the standard conditions of 95°F. dry bulb, 78°F. wet bulb and 46% relative humidity, and will take care of conditions as bad as 85°F. dry bulb, 79°F. wet bulb, 77°F. dew point and 76% relative humidity. For unusually severe conditions see table of thickness recommendations on page 27.

AVAILABLE SIZES OF CAREYDUCT

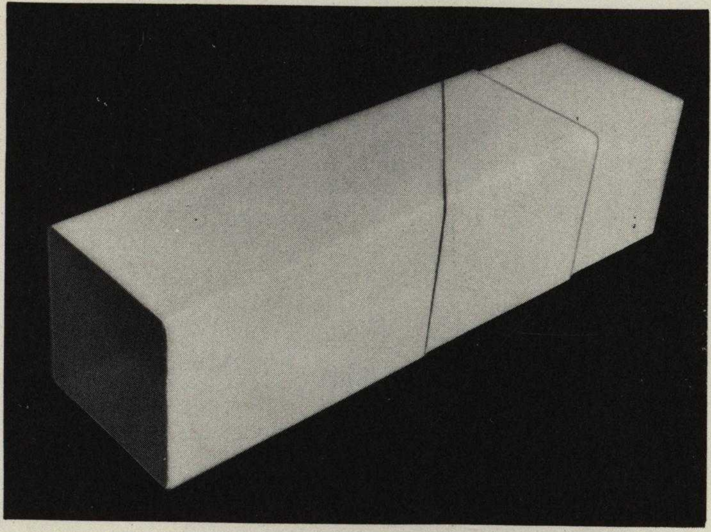
Length of sections—3 ft.
Wall thickness, total—½″ and 1″, other thicknesses to order.

STANDARD INTERNAL DIMENSIONS IN INCHES

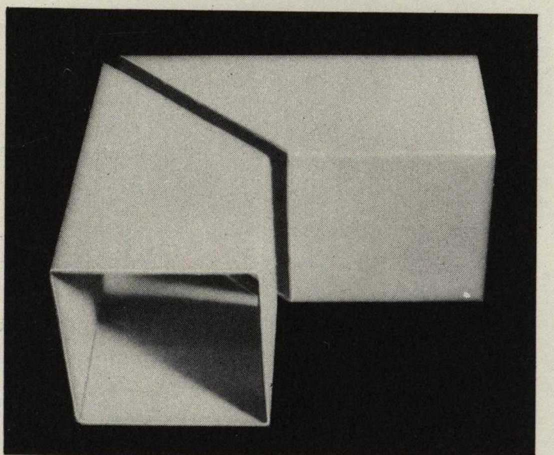
2½ x 5½	5½ x 5½	11½ x 11½	17½ x 17½
2½ x 8½	5½ x 8½	11½ x 14½	17½ x 20½
2½ x 11½	5½ x 11½	11½ x 17½	17½ x 23½
2½ x 14½	5½ x 14½	11½ x 20½	
2½ x 17½	5½ x 17½	11½ x 23½	20½ x 20½
2½ x 20½	5½ x 20½		20½ x 23½
2½ x 23½	5½ x 23½	14½ x 14½	
		14½ x 17½	23½ x 23½
4 x 5½		14½ x 20½	
4 x 8½	8½ x 8½	14½ x 23½	
4 x 11½	8½ x 11½		
4 x 14½	8½ x 14½		
4 x 17½	8½ x 17½		
4 x 20½	8½ x 20½		
4 x 23½	8½ x 23½		

CONSTRUCTION OF FITTINGS

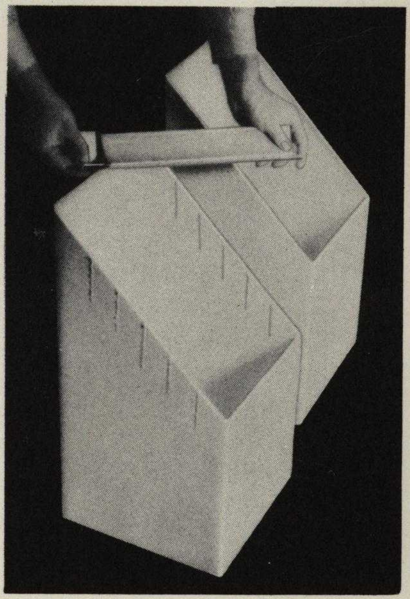
SIMPLE 90° ELBOWS



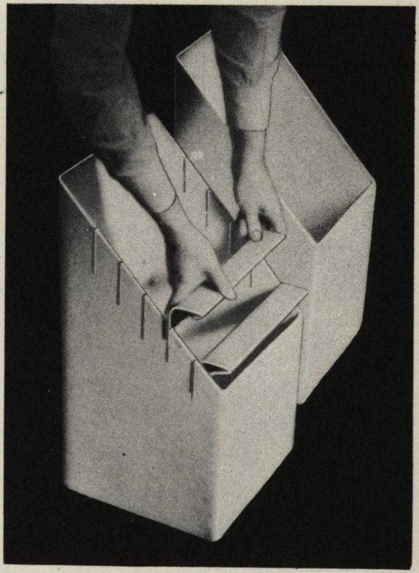
1. Pull core from jacket so that the desired length of male and female end results.
2. Cut on an angle of 45 degrees.



3. Withdraw entire core.
4. Slot core at 3″ intervals along the angular cut *parallel* to *sides of duct.* Slots to be 2″ long.



5. Cut vanes to length corresponding to measurement of inside of duct.
6. Insert clips (one right and one left) in ends of vanes as shown above.



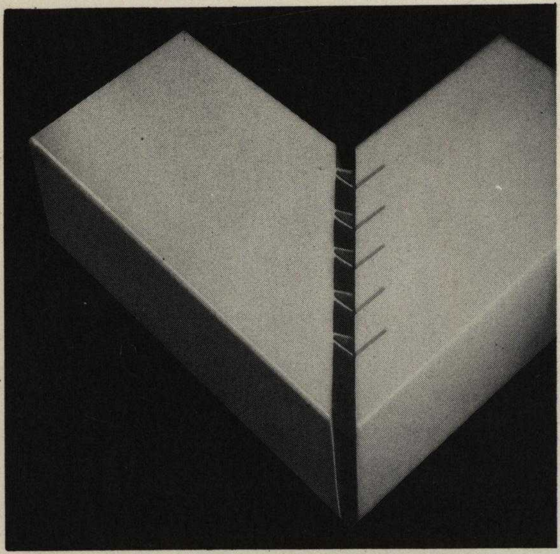
7. Insert vane assembly in slots always starting at throat of turn.

Careyduct

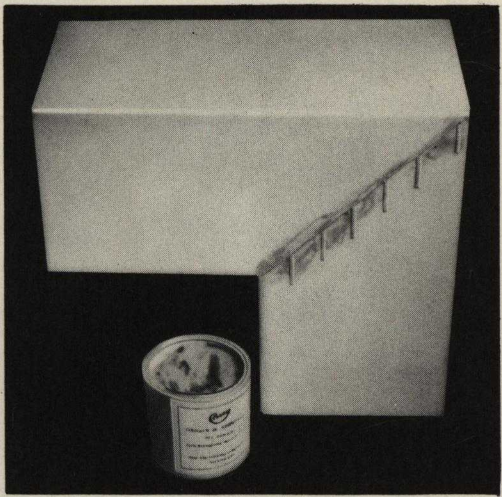
ASBESTOS INSULATED DUCT

CONSTRUCTION OF FITTINGS

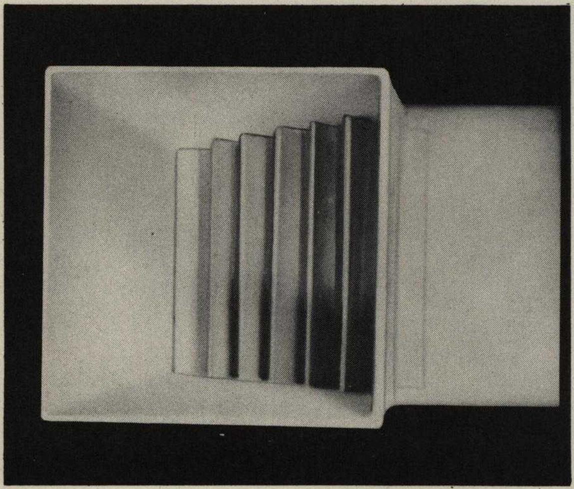
SIMPLE 90° ELBOWS



8. Assemble other side of core to make butt joint.



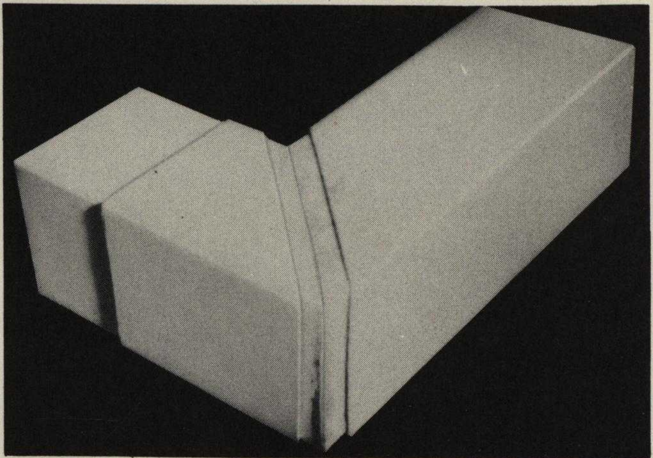
12. Apply Careyduct Adhesive to joint.



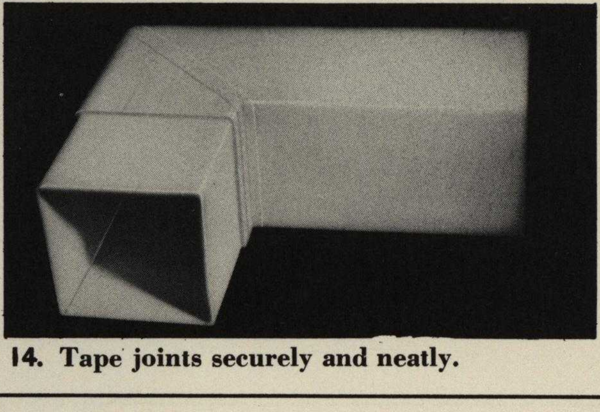
9. Hold butt joint together with pronged fasteners (see detail of method page 16).

10. Use a strip of 18 ga. steel about 3" wide under angular cut to clinch fasteners.

11. For narrow duct apply fasteners to outside of core, and clinch on the inside of the core by a suitable method.



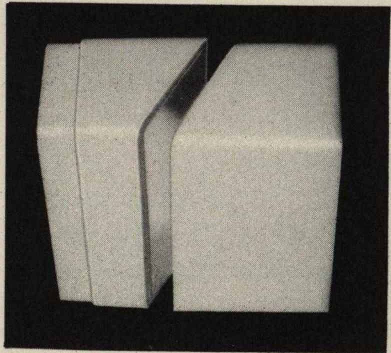
13. Assemble jackets as shown using Careyduct Adhesive applied between meeting edges to thoroughly seal the joint.



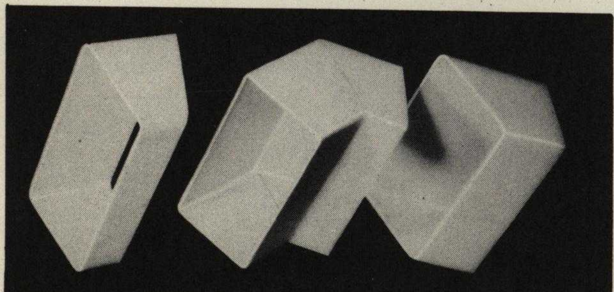
14. Tape joints securely and neatly.

CONSTRUCTION OF FITTINGS

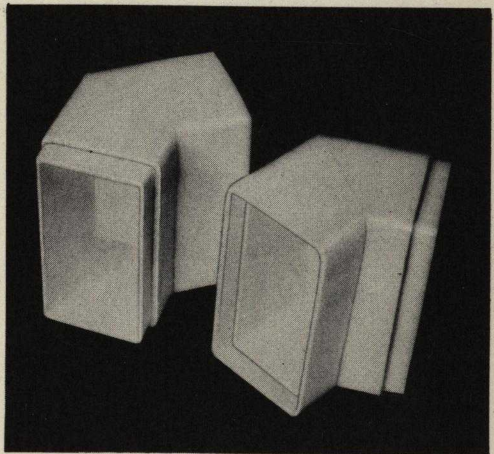
ELBOWS OTHER THAN 90°



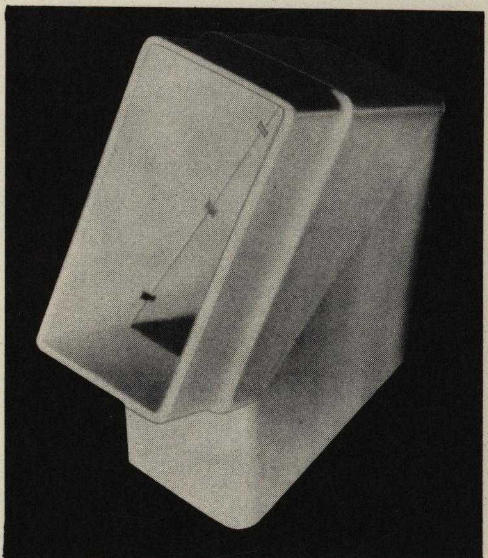
1. Extend core and cut on desired angle.



2. Separate cores from jackets.
3. Fasten cores with pronged fasteners same as for 90° elbows (no duct vanes required).



4. Assemble jackets and tape as shown.

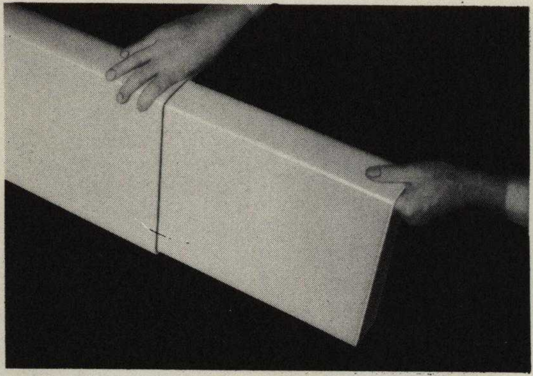


5. Finished 45 degree broad way elbow (note fasteners).

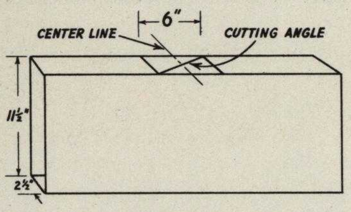
Careyduct
ASBESTOS INSULATED DUCT

CONSTRUCTION OF FITTINGS
STACKHEADS AND INCREASING ELBOWS

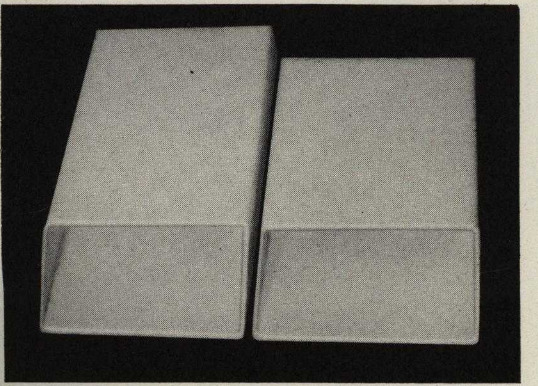
Standard 2½" x 11½" Riser to take 6" x 12" Grille



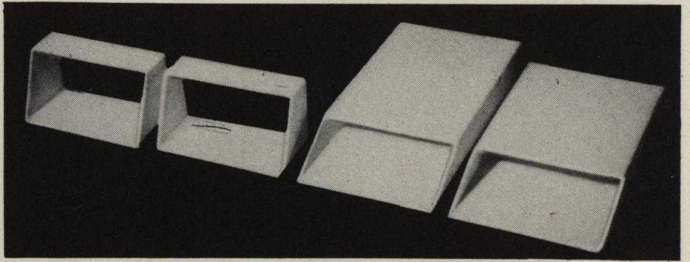
1. Separate cores entirely from jackets (both 2½"x11½" and 5½"x11½").



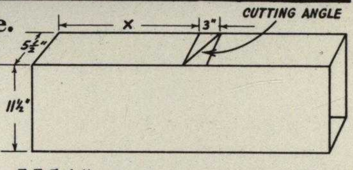
2. Locate center of length of core on the 2½" side and strike a line perpendicular to the length of the duct. Measure 3" toward each end from the center line and draw lines parallel to center line. Connect these two lines (6" apart) by a diagonal. This diagonal is the line on which to cut.



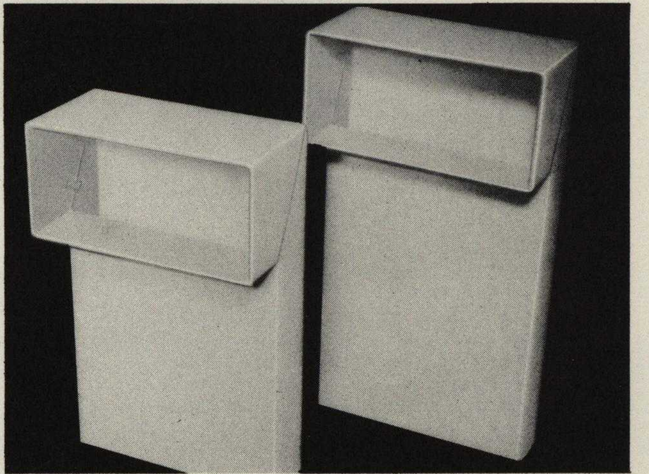
3. Make cut as shown.



4. Take 5½"x11½" core.



5. From one end of 5½"x11½" core measure toward the other end an amount equal to the distance from the outward face of the 2½"x11½" riser to 1" beyond finished plaster line, (distance x on sketch) and strike a line perpendicular to the length of the duct on the 5½" side. From this line measure an additional 3" and strike a line parallel to the first. Connect these two lines (3" apart) by a diagonal. This diagonal line is the line on which to cut.



6. Fasten 2½"x11½" cores to 5½"x11½" cores with pronged fasteners as shown above. Result—*two stackheads in one operation.*

7. Take the jacket of the 2½"x11½" duct. Locate the center of the length on the 3½" side (½" thick Careyduct) and strike a line. Measure 3½" toward each end from the center and strike lines (7" apart) forming a rectangle, the diagonal of which is the proper angle to cut.

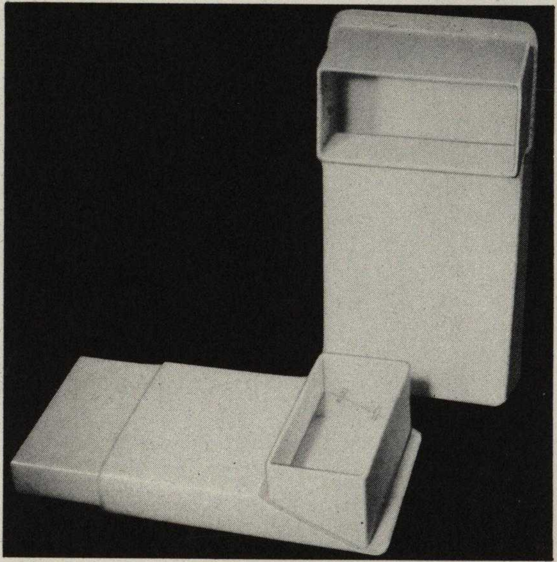
8. Cut jacket.

CONSTRUCTION OF FITTINGS

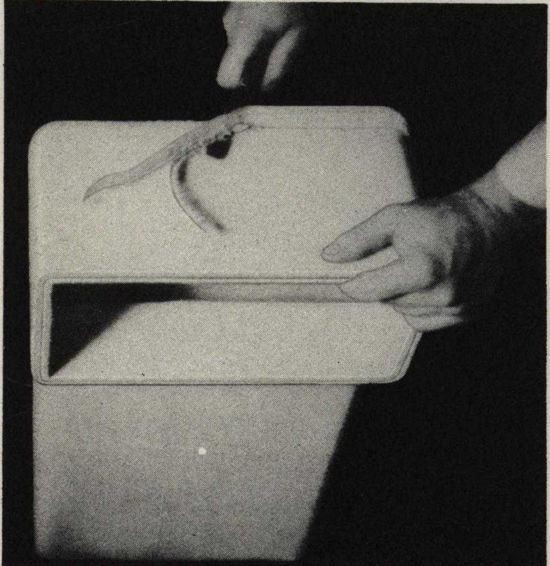
STACKHEADS AND INCREASING ELBOWS

Standard 2½" x 11½" Riser to take 6" x 12" Grille

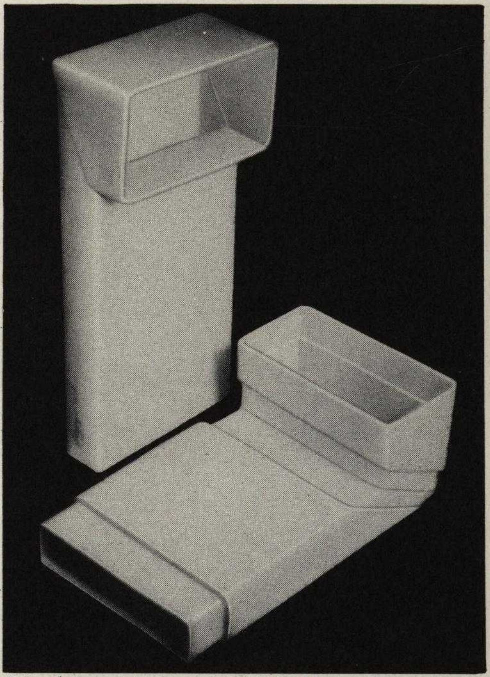
9. Take 5½"x11½" jacket. From one end measure toward the other end on the 6½" side (½" thick Careyduct) an amount equal to the distance from the outward face of the riser jacket to one inch beyond the finished plaster line, and strike a line same as on the core. From this line measure an additional 3½" and strike a line parallel to the first. Connect these two lines (3½" apart) by a diagonal. This diagonal line is the line on which to cut.



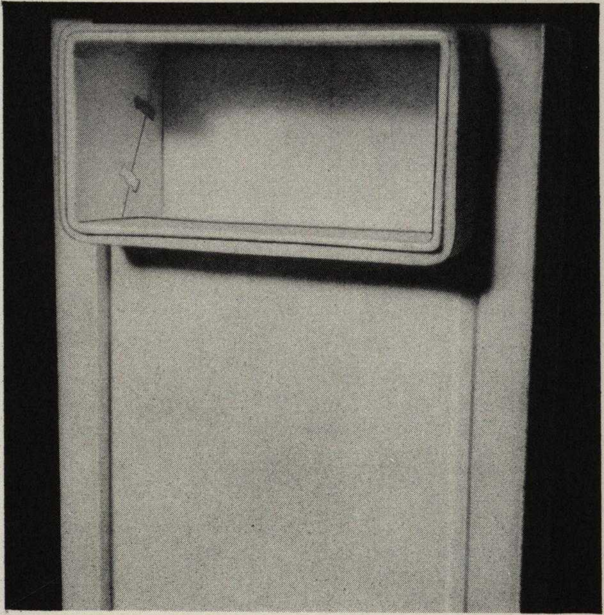
10. Slip cores into jackets.



11. Trim off excess jacket as shown above.



12. Tape and seal jackets in place with Careyduct Adhesive.



13. Finished riser, with stackhead in place ready to receive grille. Note—from this operation *two* stackheads are obtained.

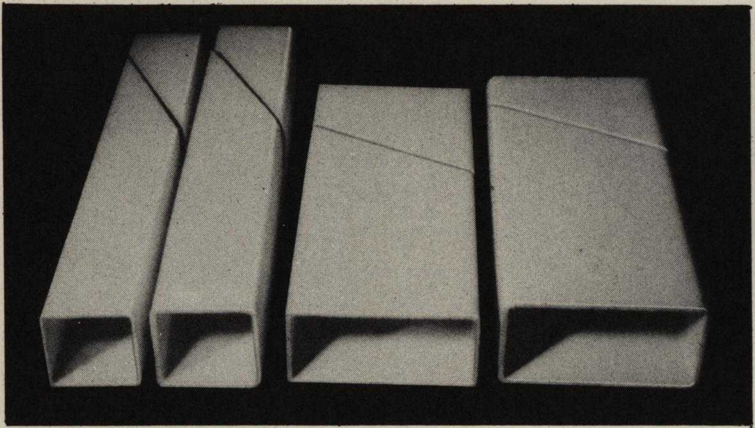
Careyduct

ASBESTOS INSULATED DUCT

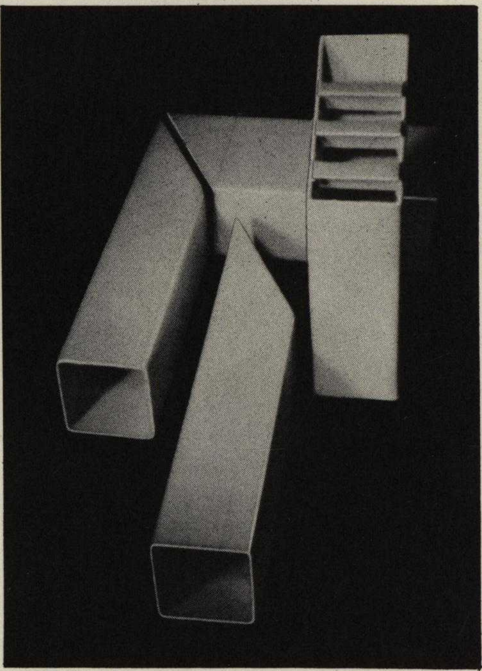
CONSTRUCTION OF FITTINGS

INCREASING ELBOWS

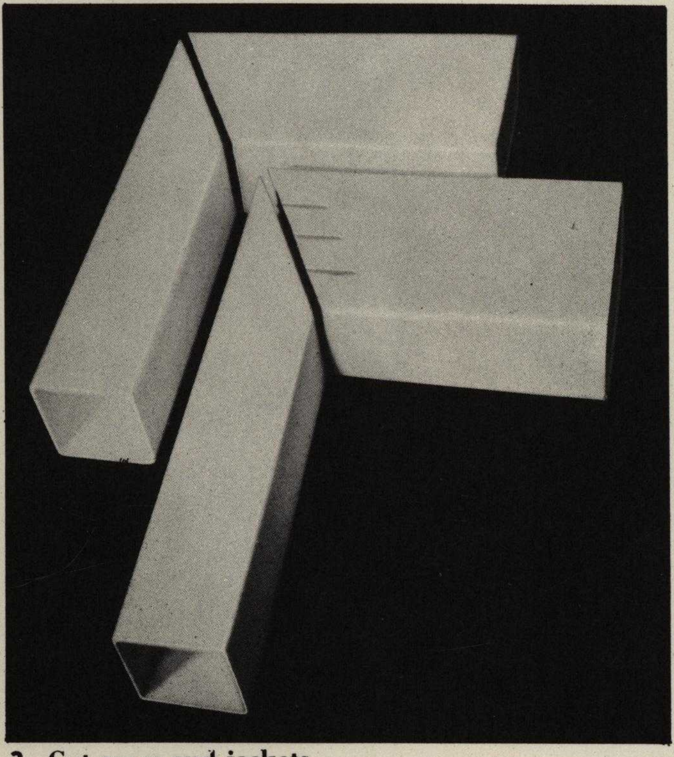
Illustrating ell increasing from 5½" x 5½" to 5½" x 11½"



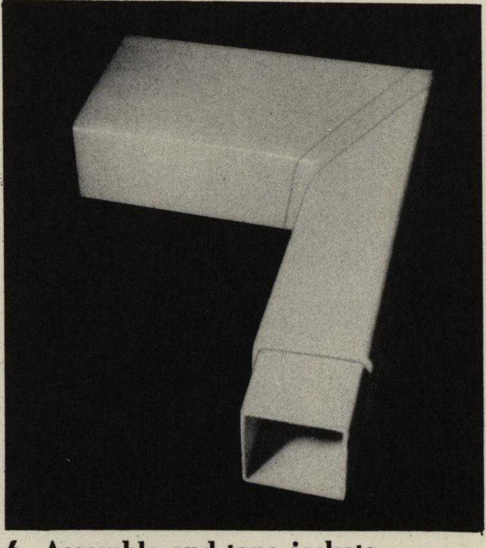
1. Separate cores from jackets.
2. Layout angular cut on core and on jacket separately. Use method similar to that outlined for stackheads. The dimensions given for stackheads will not necessarily apply to increasing ells.



4. Assemble vanes in core as shown.
5. Fasten cores securely with pronged fasteners, and seal butt joint with Careyduct Adhesive.



3. Cut cores and jackets.

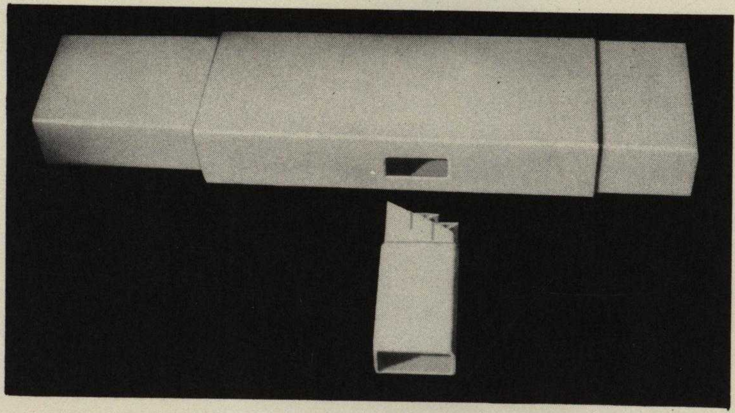


6. Assemble and tape jackets.

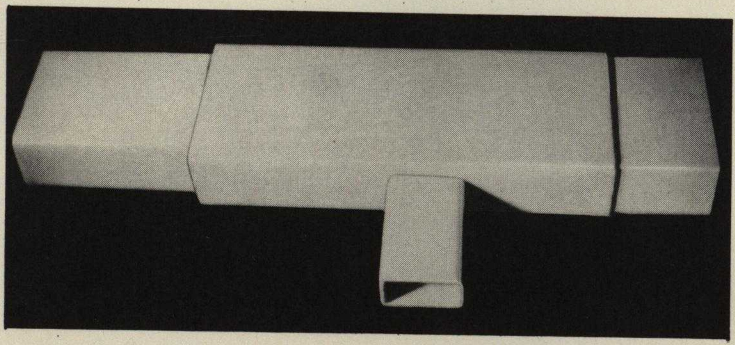
CONSTRUCTION OF FITTINGS

SIDE OUTLET TAKE-OFF AND REDUCTION IN TRUNK SIZE

SIDE OUTLET TAKE-OFF

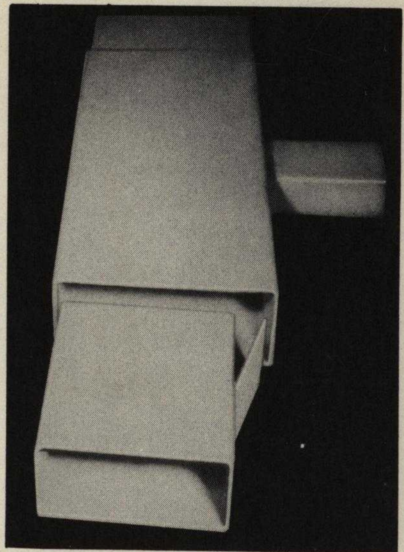


1. Cut branch to be inserted on desired angle. Insert vanes same as for 90° elbow using Careyduct Adhesive to cement them securely in place.
2. Cut hole through core and jacket of trunk duct the exact outside dimensions of CORE of branch to be inserted. This must be a snug fit.

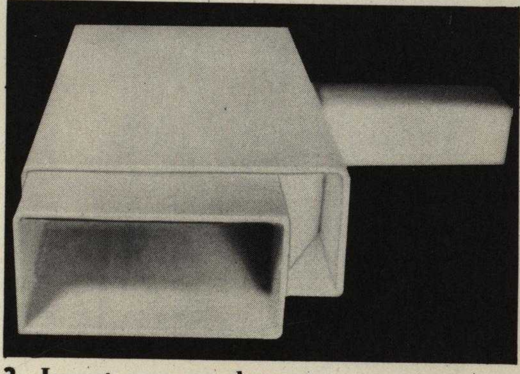


3. Insert CORE of branch in hole in trunk so that vanes face into air steam and act as a scoop.
4. Seal branch core to trunk duct with Careyduct Adhesive and butt branch jacket against trunk removing excess Careyduct Adhesive.

REDUCTION IN TRUNK SIZE



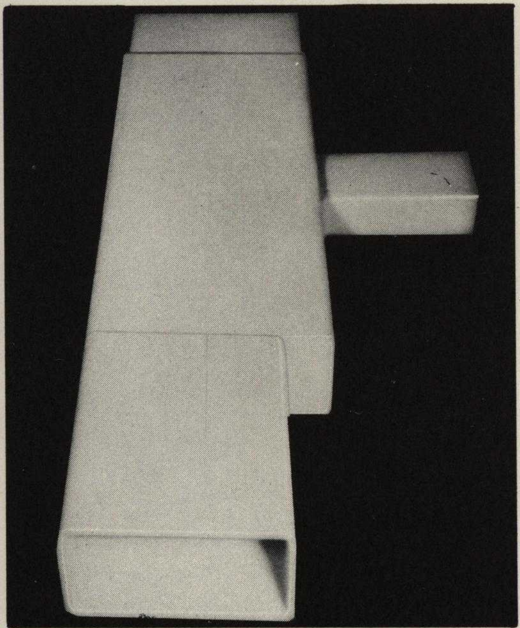
1. If possible select. duct of same depth and lesser width to reduce size of trunk.
2. Cut narrow side of selected duct to form a flap as shown, the length of which is slightly less than the length of the female joint. (This can be varied to suit conditions.)



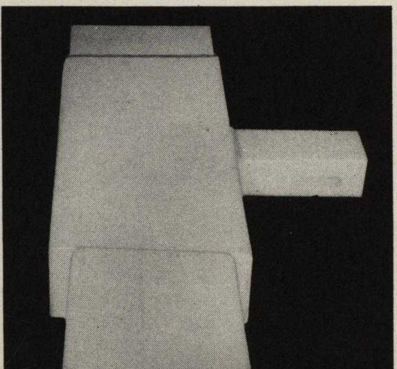
3. Insert core as shown.
4. Cement flap securely to side of larger duct with Careyduct Adhesive.

CONSTRUCTION OF FITTINGS

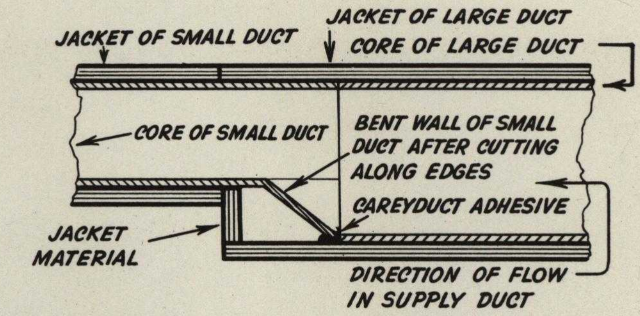
SIDE OUTLET TAKE-OFF AND REDUCTION IN TRUNK SIZE



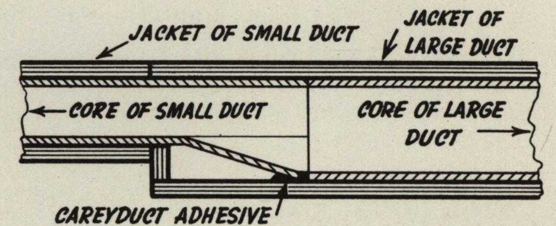
5. Blank off open space with piece of jacket cut as shown and cement in place with Careyduct Ahdesive.
6. The above shows broadway reduction. Follow same procedure in narrow way reduction. See sketches A and B.



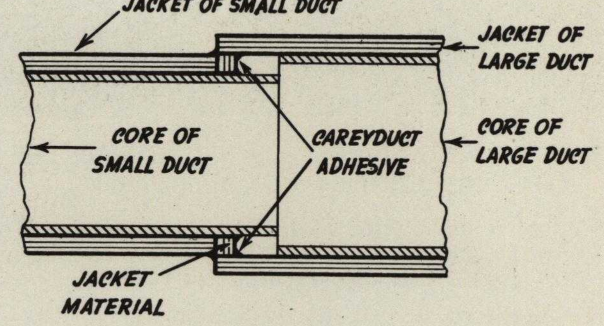
7. If reduction in duct size is not over 3 inches it is possible to insert core of smaller duct in center of larger duct and blank off as shown in sketch (C).



SKETCH A — BROAD WAY REDUCTION



SKETCH B — NARROW WAY REDUCTION

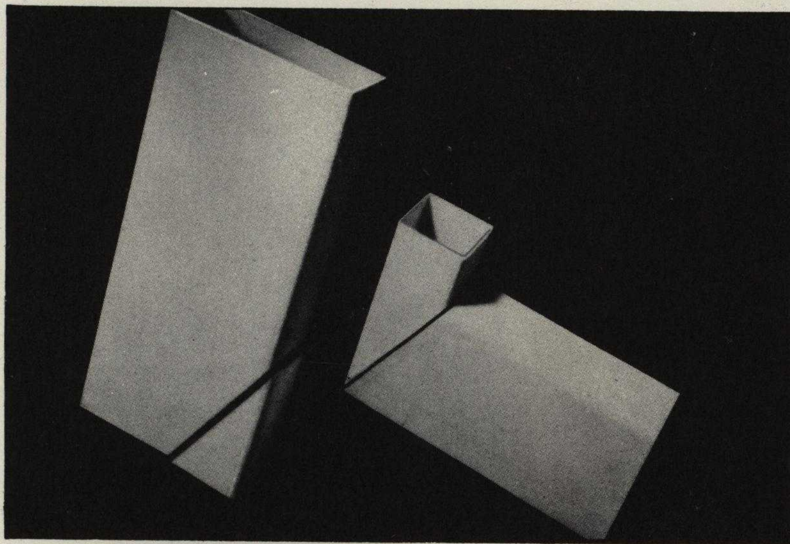


SKETCH C

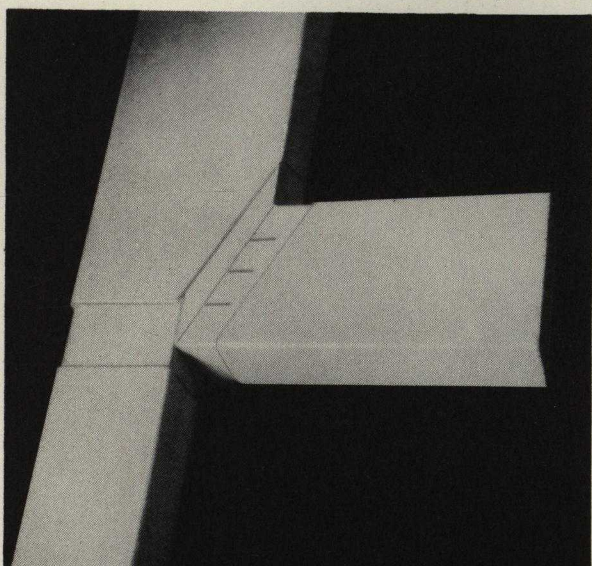
FOR SMALL REDUCTIONS CENTER CORE OF SMALL DUCT AND BLANK OFF

CONSTRUCTION OF FITTINGS

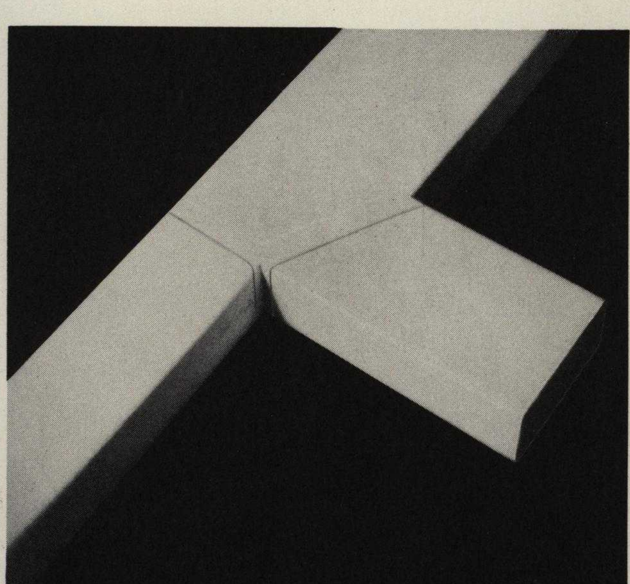
SERVICE TAKE-OFF TO REDUCE BRANCH VELOCITY



1. Make up increasing elbow as shown on page 10.
2. Layout and cut angular cut on jacket of trunk duct as shown.



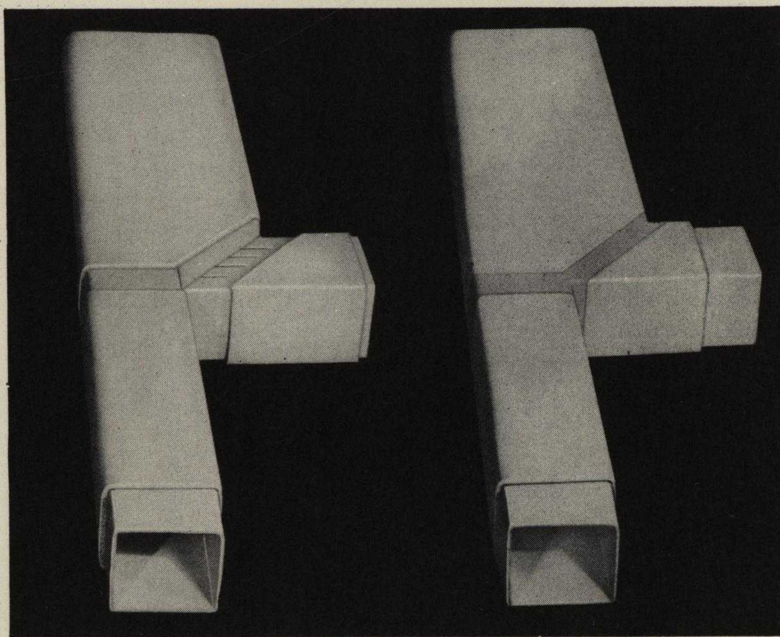
3. Insert in the trunk duct the core of the small leg of the increasing ell forming a butt joint with the core of the large end of the truck duct.
4. Then insert the small end of the truck duct butting it also aginst the core of the large end of the truck duct.



5. Slide jackets into place and tape as shown using Careyduct Adhesive to seal joints.

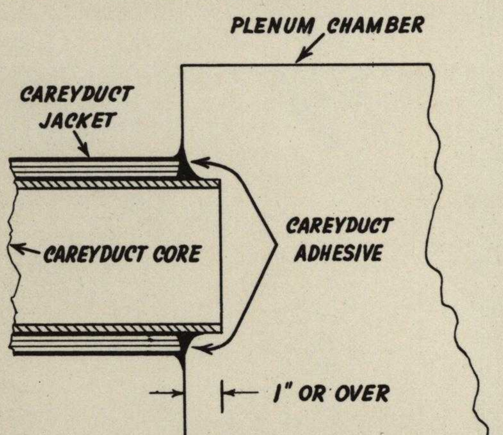
CONSTRUCTION OF FITTINGS

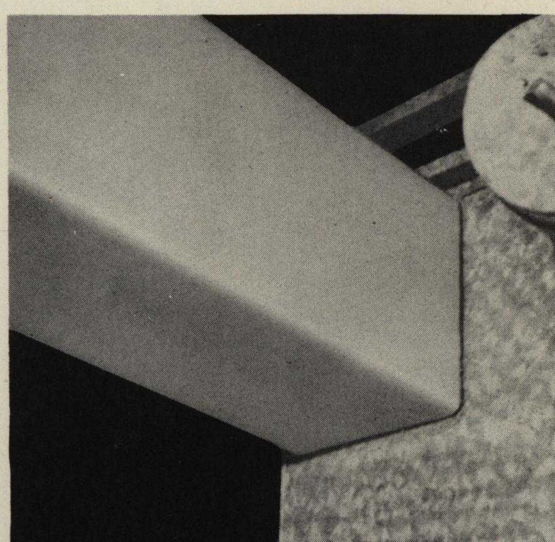
SERVICE TAKE-OFF AT CONSTANT VELOCITY



Showing Service Take-Off At Constant Velocity

JOINING TRUNK DUCT TO PLENUM CHAMBER





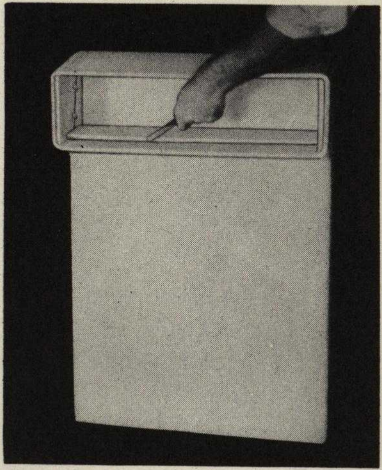
Cut hole in plenum to exact dimension of outside of *core*. Let core extend into plenum 1". Apply Careyduct Adhesive to core and end of jacket and butt jacket against outside of plenum. Where access door in plenum is available cement core in place with Careyduct Adhesive.

ALTERNATE METHOD

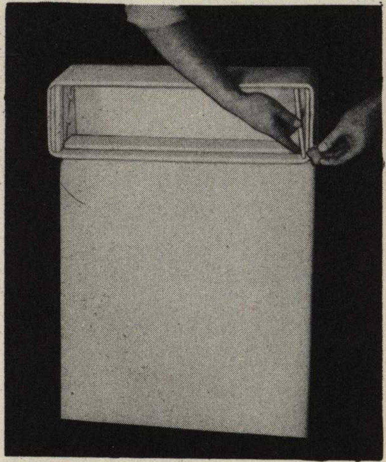
Cut hole in plenum to exact dimension of outside of core. Use standard 1½" galvanized iron collar lock joint. Fasten the metal collar to Careyduct between the core and the jacket of Careyduct using through bolts or sheet metal screws to fasten securely to collar.

ATTACHMENT OF GRILLES AND DAMPERS

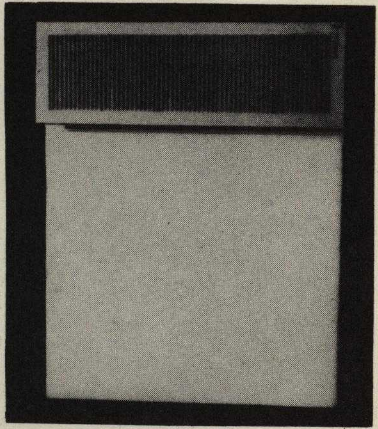
The method of attaching grilles to Careyduct is essentially the same as for attaching to sheet metal stackheads. Where grille frames do not exactly fit the corresponding size of Careyduct the following suggestions are offered to clarify this application.



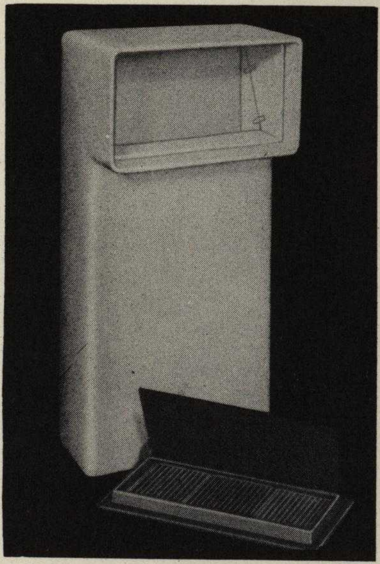
1. Trim core and jacket flush with baseboard or plaster.
2. Trim out inside of duct (core) to fit grille or frame or both, as shown above.



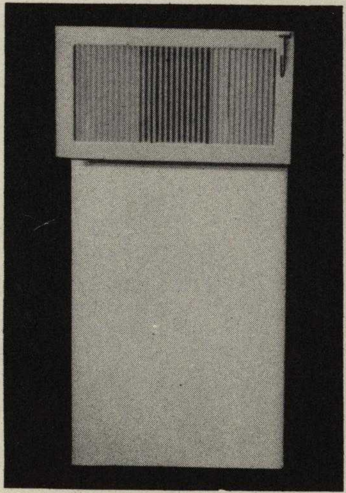
3. If duct is wider than grille or frame build up inside of core as shown using Careyduct Adhesive and core material as shown.



4. Showing 6″ x 20″ grille in place in 5½″x20½″ Careyduct.



5. For grilles having volume damper same size as frame trim damper to fit opening.



6. Showing 6″x12″ grille in place in 5½″x11½″ Careyduct.

For baseboard grille insert and screw to baseboard as provided.

Careyduct
ASBESTOS INSULATED DUCT

STANDARD FITTING ACCESSORIES

In addition to the standard size Careyduct sections, the following accessories are needed for making fittings:

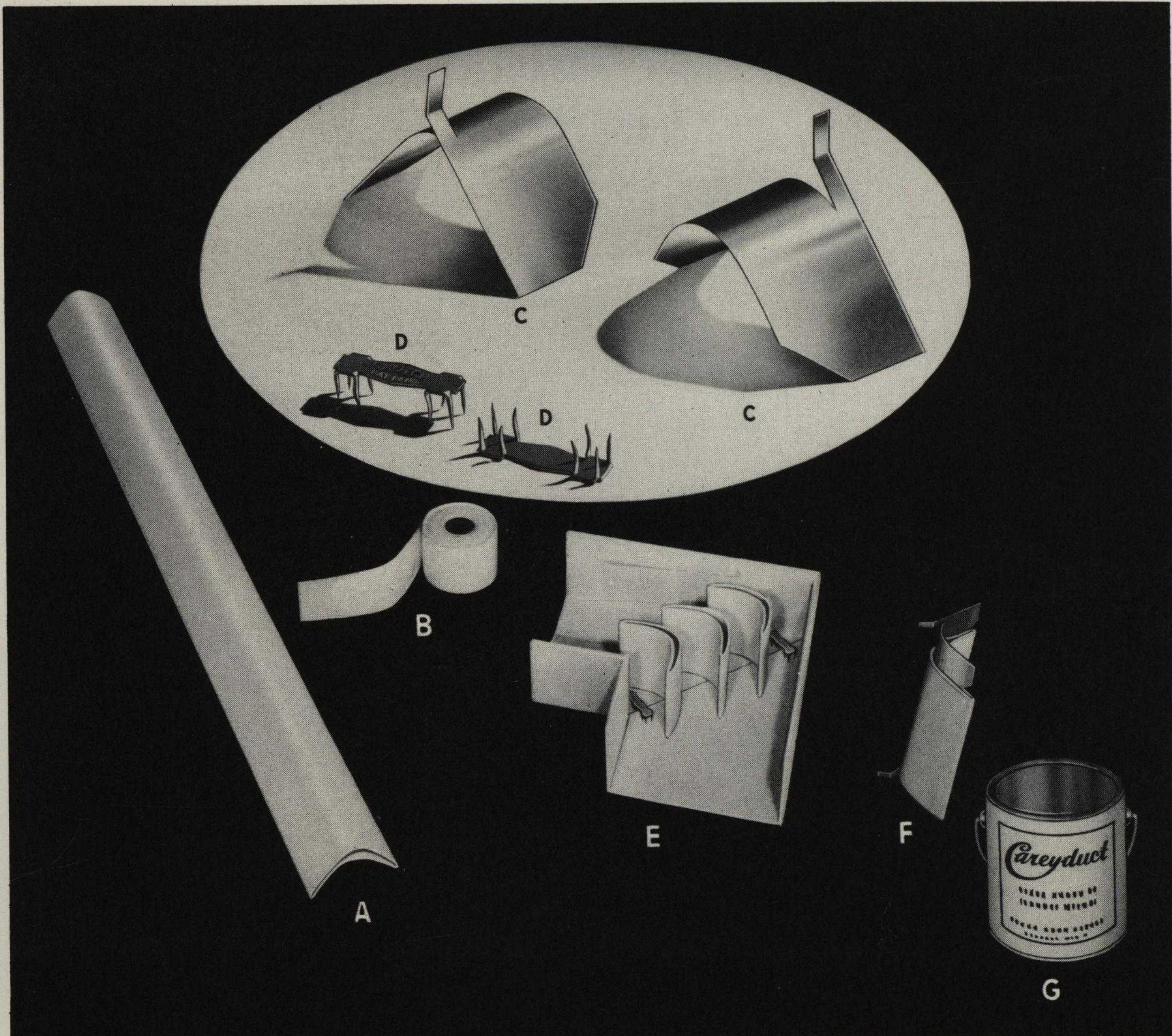
DUCT VANE—this is of rigid asbestos structure of curvature for a 90° ell and is furnished in standard three foot lengths from which proper length vanes can be cut.

VANE CLIPS—two types—one right hand and one left hand—one of each to be used in the opposite ends of the duct vanes.

PRONGED FASTENERS—these metal fasteners or cleats firmly embed themselves in the hard core and lock the sections of the fitting together.

TAPE—adhesive cloth tape for sealing joints in fittings.

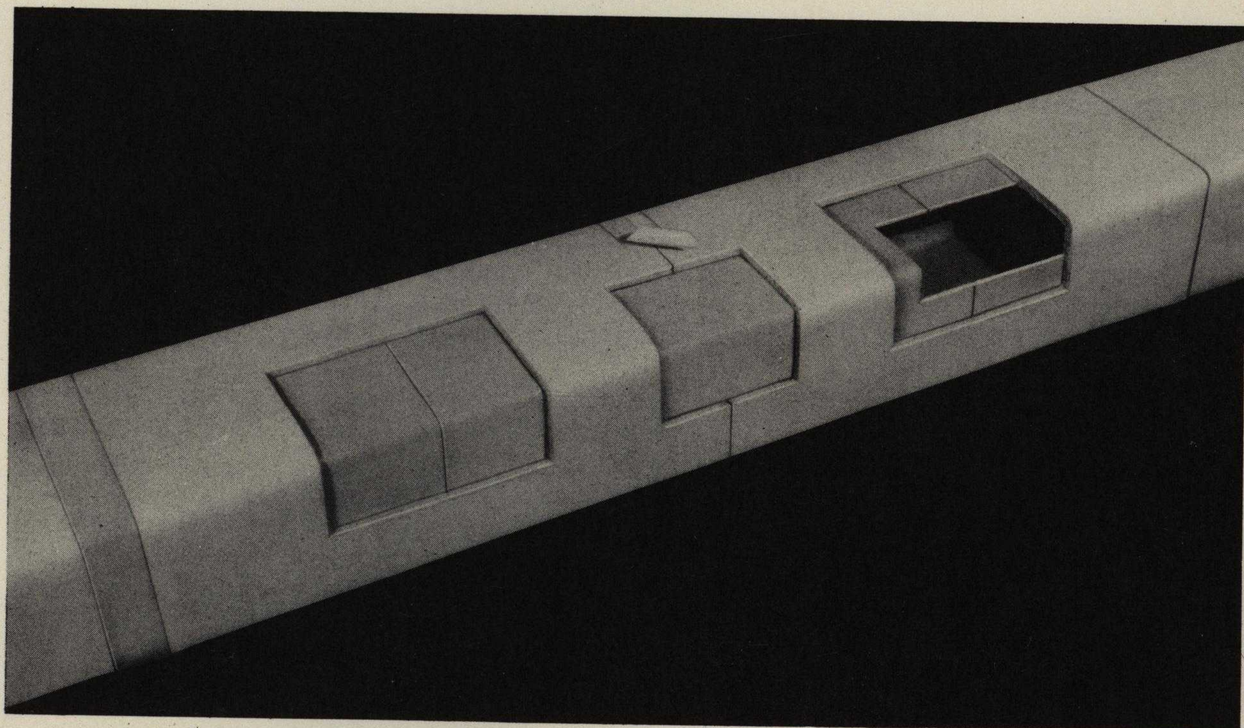
CAREYDUCT ADHESIVE—a fire resistant plastic containing asbestos fibre.



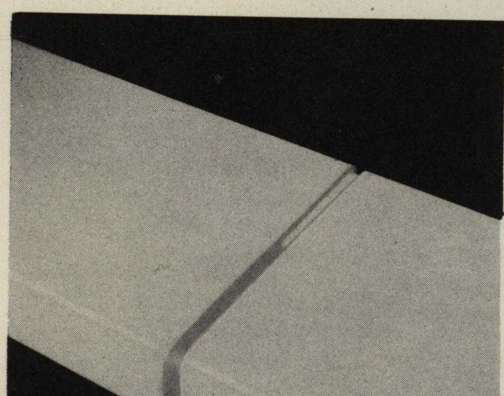
Accessories—A, 90° duct vane; B, tape; C, duct vane clips; D, Fasteners; E, cross section of elbow assembly; F, shows clips inserted into duct vane; G, Careyduct Adhesive.

METHOD OF ERECTION

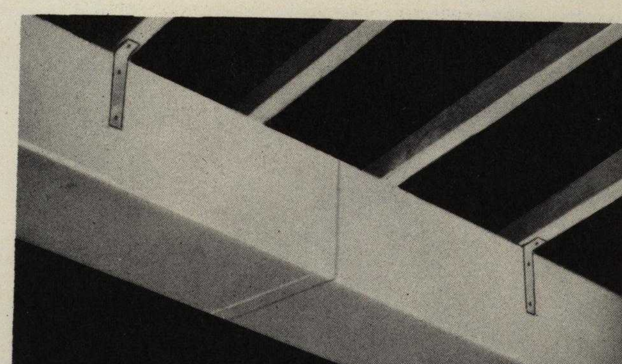
ASSEMBLY



Assembling straight runs. Cut-a-way view showing staggered joint construction.



Sealing joints with Careyduct Adhesive.



Supporting horizontal straight runs — strap hangers exposed length ⅔ depth of duct attached with metal screws of sufficient length to equal total thickness of core and jacket plus ¼″ to ⅜″.

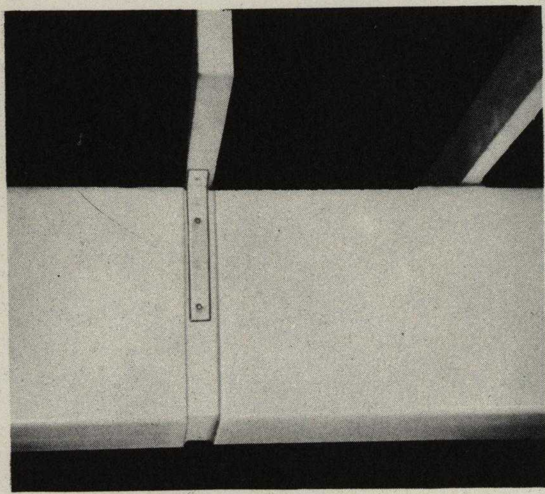
Careyduct

ASBESTOS INSULATED DUCT

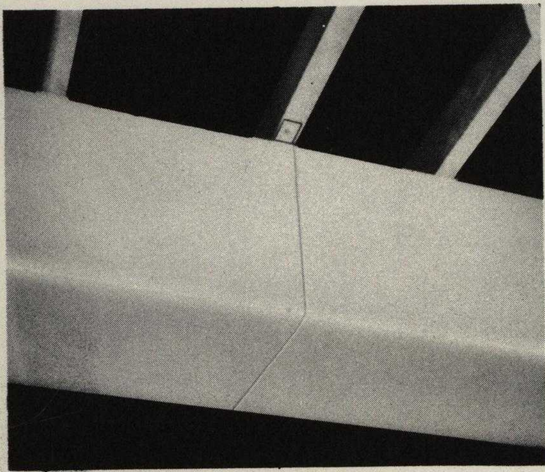
METHOD OF ERECTION

ASSEMBLY

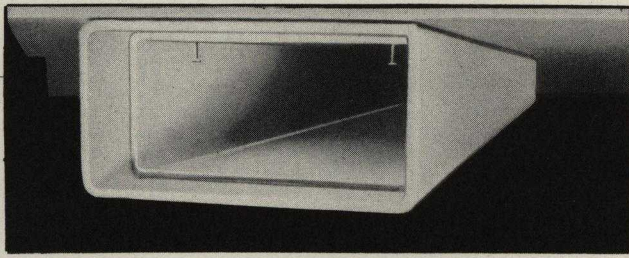
METHOD OF CONCEALING STRAP HANGERS BETWEEN JACKET AND CORE AT JOINT OF JACKET.



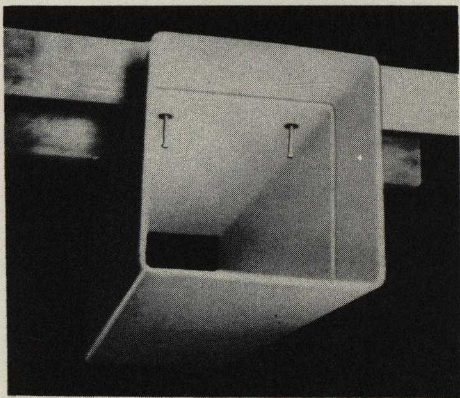
Strap hanger fastened directly to core with sheet metal screws before jackets are butted together.



Strap hanger concealed after jackets are butted together.

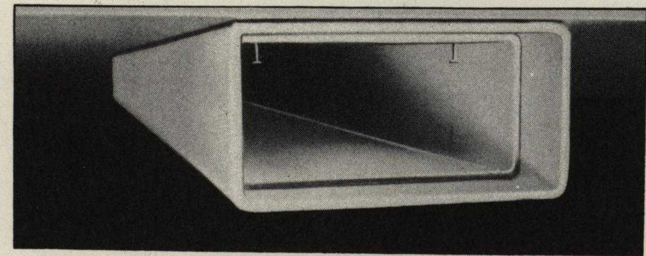


1. Attaching to ceiling with roofing nails and washers.

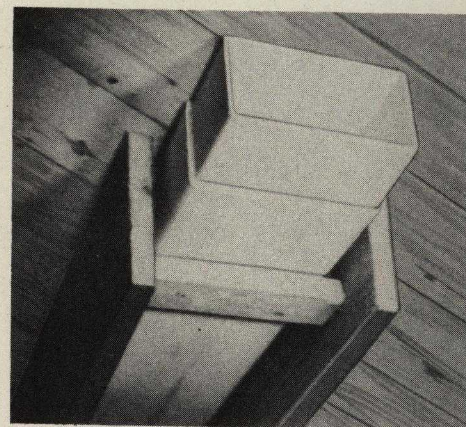


2. Attaching directly to ceiling with washers using expansion bolts into expansion shells; Toggle bolts through lath and plaster; or screwing directly to joists with washers. Bolts should be placed as closely to the edges as possible and Careyduct should never be hung by one bolt or screw or nail in the center. Washers should cover at least one square inch of area, and may be made by punching holes in the center of one inch squares of 20 to 22 gauge galvanized metal.

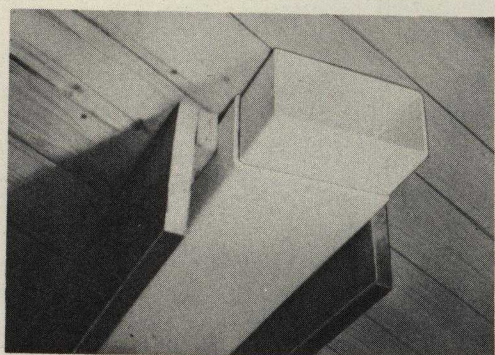
METHOD OF ERECTION
HANGING-RECESSED SUSPENSION



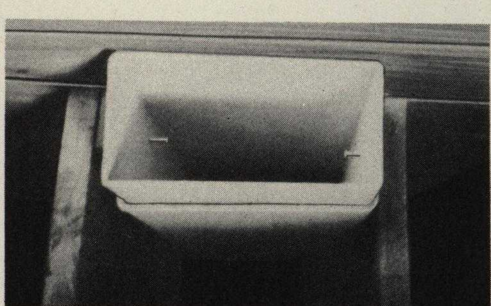
Screwed or nailed to sub floor using washers.

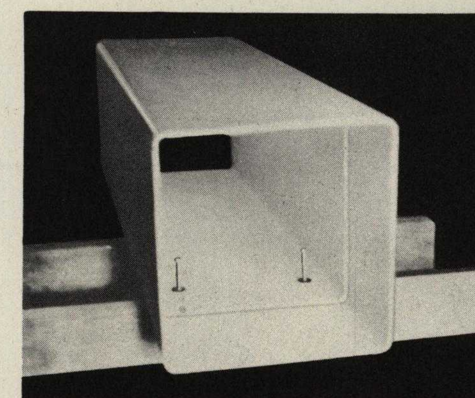


Horizontal support below duct across recessed space.

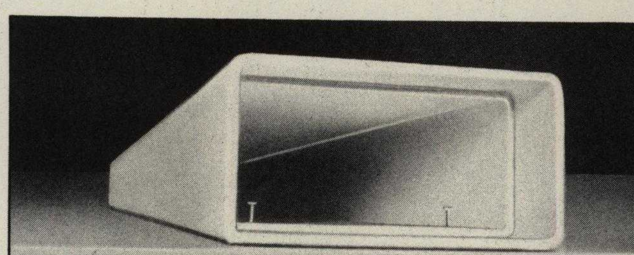


***Photos above and below:* Screwed or nailed to side of joist, or fillet and joist on opposite side.**





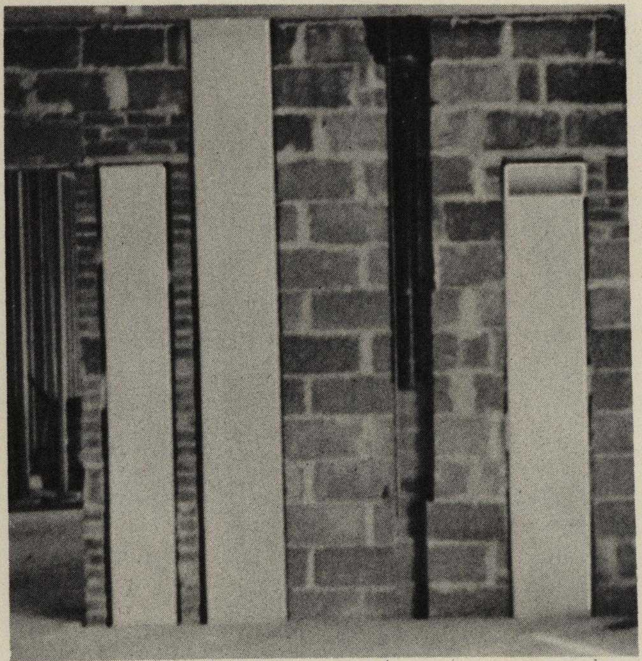
***Photos above and below:* Resting on floors, joists or other horizontal surfaces. Nail or screw each section to floor or joist to prevent movement.**



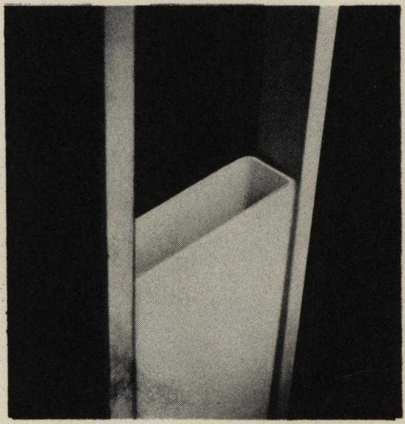
Careyduct
ASBESTOS INSULATED DUCT

METHOD OF ERECTION
SUPPORT OF VERTICAL RISERS — TRENCHES

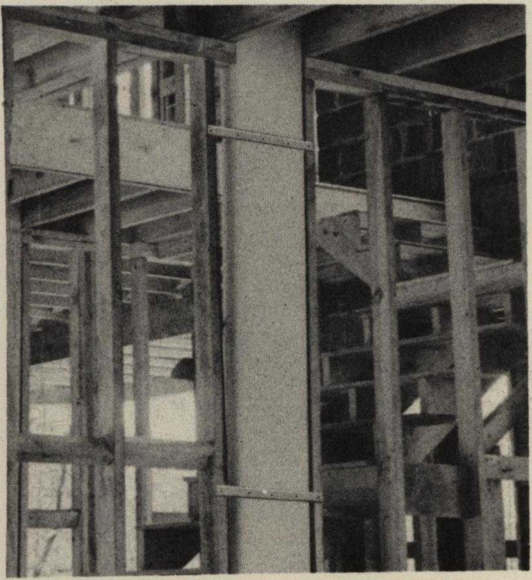
SUPPORT OF VERTICAL RISERS



Where Careyduct is in tile, brick, cinder block, or concrete chase use expansion bolts and shields or toggle bolts with washers between head of bolt and core for fastening.

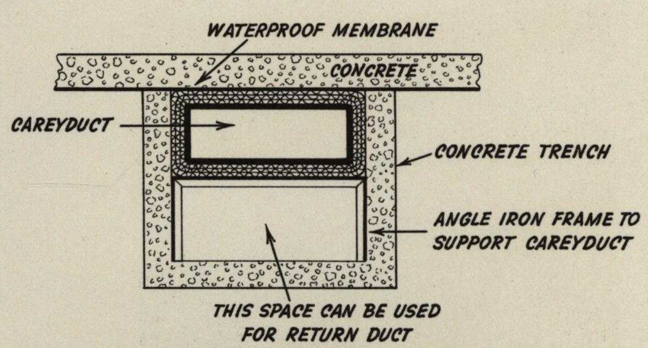


Nail or screw to studding.

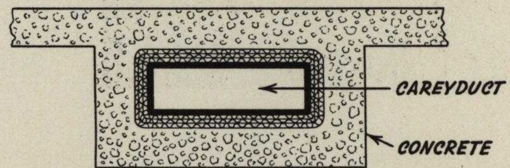


Small risers between studding use straps across recessed space sheet metal screwing to Careyduct.

TRENCHES



If run in trench support above trench floor and waterproof Careyduct.

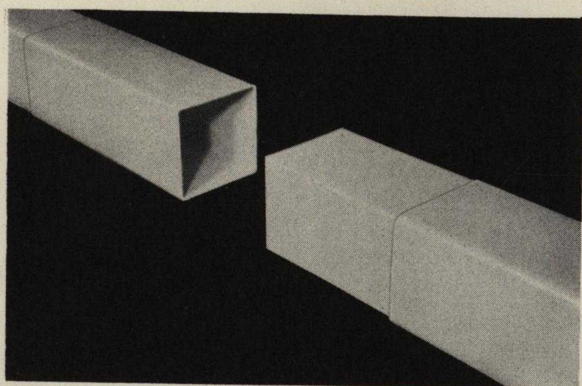


If embedded in concrete, Careyduct must be covered with waterproof membrane. Careyduct may be used as a form when the trench is poured.

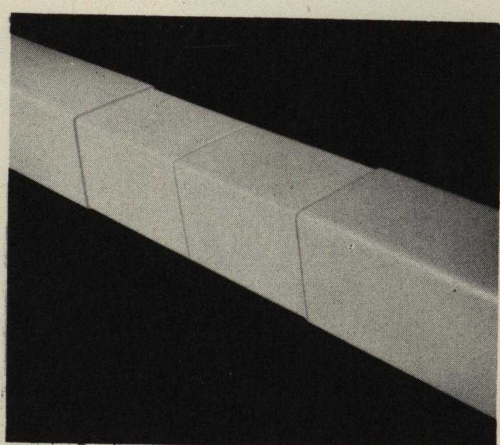
METHOD OF ERECTION

ASSEMBLY — STRAIGHT RUNS

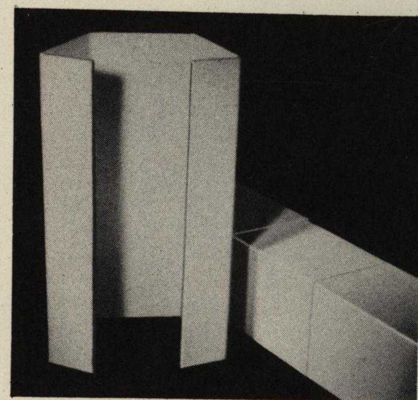
JOINING TWO ENDS OF THE SAME DUCT



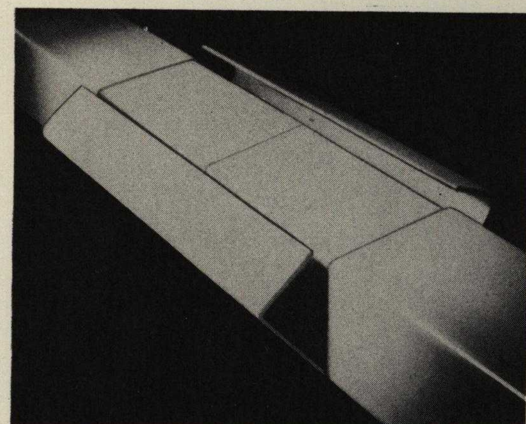
1. Core of one duct and jacket of the other in place, both ducts same size.



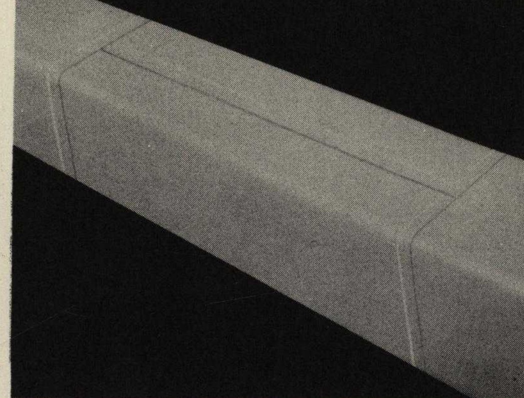
2. Insert required length of core in female joint as shown, and butt against core. This same piece of inserted core butting against extended core of male joint.



3. Jacket split in preparation to placing over joint.

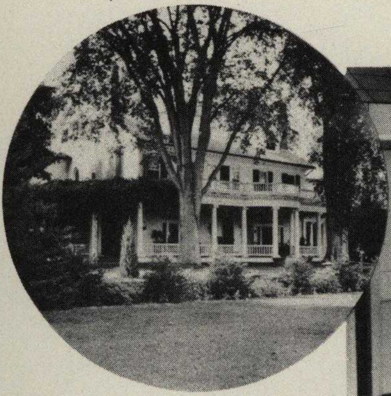


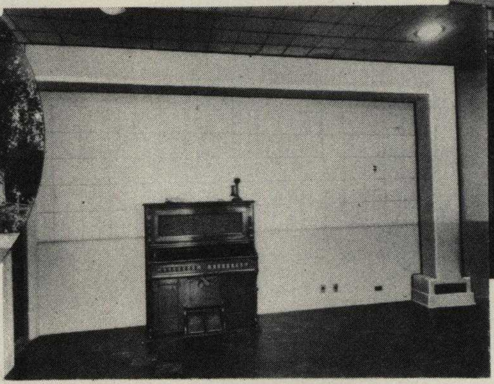
4. Jacket being placed around core.

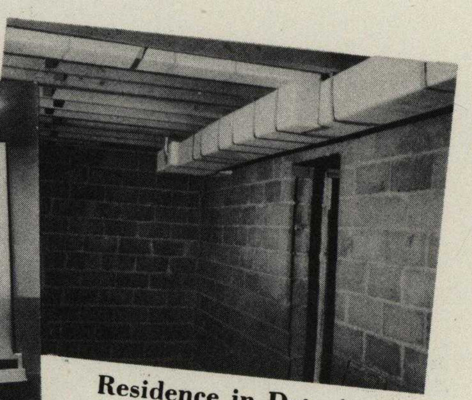


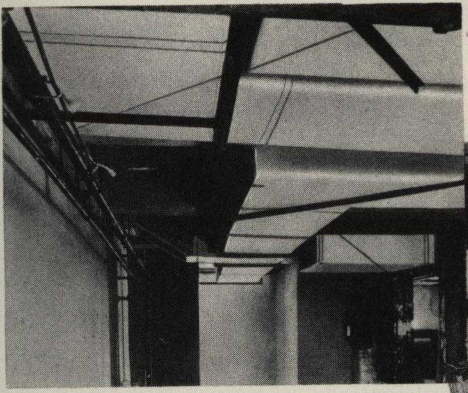
5. Jacket in place sealed and taped.

TYPICAL USERS OF CAREYDUCT

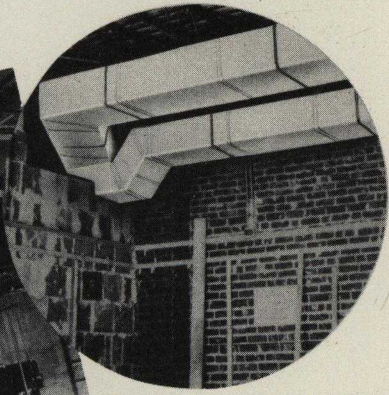

Residence in Connecticut

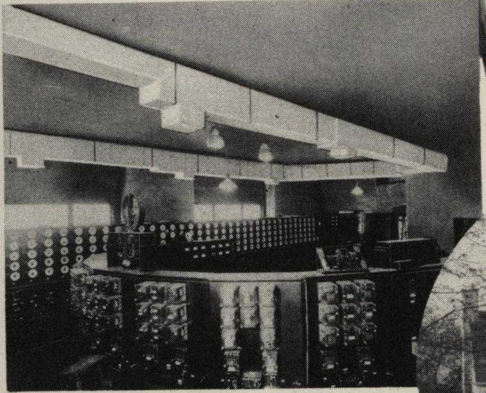

Radio Station in Oklahoma


Residence in Detroit


Bank in New York City


Industrial in Canada


Power Plant in Virginia


Power Plant in Cincinnati


Residence in Indian Hill, Ohio


Manufacturers Office in Cincinnati

INSULATION CHARACTERISTICS

Thermal conductivities of Careyduct construction were determined at Mellon Institute of Industrial Research of the University of Pittsburgh.

The following tables of heat transmission per lineal foot of Careyduct are based upon these conductivity values, assuming that the duct surface is exposed to the surrounding air on all four sides. These tables permit rapid and accurate determination of total heat losses for winter conditioning or total heat absorption for summer conditioning for the duct system. No additional allowances need be made for leakage losses. Careyduct systems are tight systems when properly installed. Thermal transmission losses are the only ones which need be considered.

<u>B. T. U. LOSS PER LINEAL FOOT PER HOUR PER DEGREE F. DIFFERENCE IN TEMPERATURE BETWEEN AIR INSIDE AND OUTSIDE OF CAREYDUCT</u>
(based on exposure to surrounding air on all four sides.)

	Summer Air Conditioning Systems Average Temperature Difference 25°F Wall Thicknesses					Winter Air Conditioning Systems Average Temperature Difference 105°F Wall Thicknesses				
	½″	¾″	1″	1½″	2″	½″	¾″	1″	1½″	2″
2½″ x 5½″	.866	.695	.578	.432	.345	.893	.725	.602	.456	.365
2½″ x 8½″	1.189	.954	.794	.594	.475	1.233	.995	.829	.627	.502
2½″ x 11½″	1.510	1 210	1.010	.755	.604	1.562	1.262	1.052	.796	.640
2½″ x 14½″	1.830	1.460	1.220	.915	.760	1.893	1.528	1.280	.966	.774
2½″ x 17½″	2.075	1.720	1.435	1.079	.860	2.166	1.750	1.462	1.105	.886
2½″ x 20½″	2.450	1.970	1.640	1.240	1.024	2.541	2.059	1.720	1.303	1.042
2½″ x 23½″	2.760	2.220	1.852	1.392	1.110	2.870	2.320	1.944	1.470	1.180
5½″ x 5½″	1.180	.950	.790	.593	.473	1.229	.994	.829	.625	.500
5½″ x 8½″	1.500	1.205	1.001	.755	.652	1.560	1.263	1.051	.796	.637
5½″ x 11½″	1.825	1.460	1.210	.915	.730	1.890	1.528	1.275	.964	.774
5½″ x 14½″	2.150	1.715	1.425	1.075	.860	2.200	1.792	1.497	1.132	.906
5½″ x 17½″	2.460	1.970	1.640	1.235	.985	2.544	2.058	1.720	1.300	1.043
5½″ x 20½″	2.770	2.220	1.855	1.395	1.110	2.875	2.320	1.942	1.470	1.179
5½″ x 23½″	3.080	2.460	2.060	1.550	1.240	3.199	2.580	2.160	1.633	1.310
8½″ x 8½″	1.830	1.460	1.220	.912	.728	1.883	1.524	1.275	.962	.771
8½″ x 11½″	2.140	1.720	1.432	1.072	.860	2.210	1.797	1.501	1.130	.907
8½″ x 14½″	2.390	1.980	1.640	1.235	.983	2.541	2.060	1.720	1.297	1.042
8½″ x 17½″	2.780	2.225	1.860	1.392	1.115	2.870	2.321	1.940	1.463	1.179
8½″ x 20½″	3.100	2.480	2.070	1.525	1.275	3.200	2.585	2.162	1.630	1.311
8½″ x 23½″	3.400	2.730	2.280	1.720	1.365	3.520	2.840	2.382	1.798	1.445
11½″ x 11½″	2.450	1.970	1.640	1.230	.985	2.540	2.058	1.718	1.290	1.042
11½″ x 14½″	2.775	2.225	1.860	1.395	1.115	2.870	2.321	1.940	1.465	1.179
11½″ x 17½″	3.100	2.480	2.070	1.560	1.240	3.200	2.585	2.165	1.632	1.310
11½″ x 20½″	3.400	2.740	2.280	1.720	1.370	3.525	2.845	2.382	1.798	1.445
11½″ x 23½″	3.720	3.000	2.499	1.880	1.500	3.850	3.115	2.610	1.965	1.580
14½″ x 14½″	3.080	2.470	2.065	1.550	1.240	3.210	2.600	2.170	1.635	1.315
14½″ x 17½″	3.400	2.730	2.275	1.710	1.365	3.530	2.860	2.390	1.801	1.450
14½″ x 20½″	3.720	2.990	2.480	1.870	1.495	3.859	3.120	2.605	1.965	1.580
14½″ x 23½″	4.040	3.250	2.700	2.030	1.620	4.170	3.380	2.830	2.130	1.715
17½″ x 17½″	3.710	3.000	2.495	1.880	1.495	3.850	3.110	2.610	1.965	1.580
17½″ x 20½″	4.040	3.250	2.700	2.030	1.620	4.180	3.380	2.830	2.135	1.718
17½″ x 23½″	4.350	3.500	2.910	2.199	1.750	4.510	3.645	3.050	2.300	1.851
20½″ x 20½″	4.350	3.500	2.920	2.190	1.742	4.510	3.645	3.050	2.300	1.851
20½″ x 23½″	4.660	3.750	3.125	2.345	1.870	4.840	3.910	3.279	2.470	1.985
23½″ x 23½″	4.980	4.000	3.340	2.510	2.000	5.170	4.180	3.500	2.640	2.120

INSULATION CHARACTERISTICS

HEAT TRANSMISSION CHARACTERISTICS

The thermal conductivity values obtained at Mellon Institute of Industrial Research University of Pittsburgh on samples of Careyduct were 0.622 Btu. per sq. ft. per hr., per in. of thickness per °F., at a mean temperature of 50°F. and 0.707 Btu. at a mean temperature of 150°F. The conductivity at mean temperatures between these two values is a straight line function of the mean temperature.

The thermal transmission coefficient for various temperature conditions, etc., can be calculated from the standard formula,

$$U = \frac{1}{\frac{1}{f_i} + \frac{L}{k} + \frac{1}{f_o}} \qquad (1)$$

where

- U Btu. per sq. ft. per hr. per °F. difference in temperature between the air inside and the air outside the duct
- f_i Film conductance inside the duct, Btu. per hr. per sq. ft. per °F.
- f_o film conductance outside the duct, Btu. per hr. per sq. ft. per °F.
- k conductivity of the duct, Btu. per hr. per sq. ft. per °F. per in. of thickness.
- L thickness of the duct, in.

It will be found that f_i will vary considerably with the velocity and the size of the duct. An average value of $f_i = 4$ has been used for the calculations herein. The outside surface conductance f_o will vary somewhat with the size of the duct for small ducts and for metal ducts it will vary considerably with the emissivity (ρ) of the outside surface of the duct. Values of f_o for various conditions can be calculated from data given by Heilman* and others.

The heat losses were calculated by means of equation (1) using a value of 4 for f_i and various values for f_o as calculated from radiation and convection values given by Heilman*. The values of k for Careyduct were obtained from a curve drawn through the points mentioned above.

* - Senior Industrial Fellow, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa.

CHANGE OF AIR TEMPERATURE IN CAREYDUCT

SUMMER OR WINTER CONDITIONING

Asbestos is usually associated only with high temperature insulation. Careyduct, however, is equally valuable and specifically designed for summer air conditioning duct systems. Similar asbestos cellular insulation has been in use and under careful observation since 1935 in a number of commercial cooling systems. The results have been excellent.

The following equation can be used for computing temperature change of air over any given length of Careyduct.

$$T = \frac{Ti - To}{e^{\left(\frac{UPL}{60\,Advc}\right)}} + To \qquad (2)$$

where

T = final temperature of air in duct, °F.
Ti = initial temperature of air in duct, °F.
To = outside air temperature, °F.
U = thermal transmittance of duct, Btu. per hr. per sq. ft. per °F.
P = perimeter of duct, ft.
L = length of duct, ft.
A = area of duct, sq. ft.
d = density of air, lb. per cu. ft.
v = velocity of air, ft. per min.
c = specific heat of air, Btu. per lb. per °F.
e = Naperian base of logarithms 2.718.

Observed losses with Careyduct exposed to the air on all four sides for several selected conditions check closely the calculated values.

CALCULATED HEAT TRANSMISSION CHARACTERISTICS FOR CAREYDUCT
CAREYDUCT EXPOSED TO SURROUNDING AIR ON ALL 4 SIDES.

(Air in Duct Initially at 175°F., Outside Air Temperature, 70°F.)

Duct Size	Velocity 500 f.p.m. Btu. loss per lineal ft. ½ in. thick asb. duct	Velocity 500 f.p.m. Temperature drop, °F. in 50 ft. of duct ½ in. thick asb. duct	Velocity 1000 f.p.m. Btu. loss per lineal ft. ½ in. thick asb. duct	Velocity 1000 f.p.m. Temperature drop, °F. in 50 ft. of duct ½ in. thick asb. duct
2½ × 5½	56.3	65.5	70.3	40.8
2½ × 11½	105.3	58.6	126.5	35.2
2½ × 17½	154.3	56.3	184.5	33.7
5½ × 5½	90.9	48.1	103.2	27.3
5½ × 14½	185.7	37.3	207.0	20.8
5½ × 20½	238.0	33.8	264.0	18.7
8½ × 8½	155.0	34.3	171.4	19.0
8½ × 17½	250.5	27.0	270.0	14.5
8½ × 23½	309.5	24.6	334.0	13.3
11½ × 11½	219.0	26.5	236.0	14.3
11½ × 20½	314.0	21.3	346.0	11.4
14½ × 14½	286.0	21.8	308.0	11.7
14½ × 23½	383.0	18.0	405.0	9.5
17½ × 17½	350.0	18.3	371.0	9.7
17½ × 23½	416.0	16.2	437.0	8.5
20½ × 20½	415.0	15.8	437.0	8.3
23½ × 23½	483.0	14.0	505.0	7.3

(Air in Duct Initially at 60°F., Outside Air Temperature 80°F.)

Duct Size	Velocity 500 f.p.m. Btu. loss per lineal ft. ½ in. thick asb. duct	Velocity 500 f.p.m. Temperature rise, °F. in 50 ft. of duct ½ in. thick asb. duct	Velocity 1000 f.p.m. Btu. loss per lineal ft. ½ in. thick asb. duct	Velocity 1000 f.p.m. Temperature rise, °F. in 50 ft. of duct ½ in. thick asb. duct
2½ × 5½	10.7	10.2	12.6	6.0
2½ × 11½	19.7	9.0	22.3	5.2
2½ × 17½	28.7	8.6	32.7	4.9
5½ × 5½	16.6	7.2	18.9	4.1
5½ × 14½	32.8	5.5	35.8	3.0
5½ × 20½	43.1	5.0	46.6	2.7
8½ × 8½	28.1	5.1	29.8	2.7
8½ × 17½	44.3	3.9	47.7	2.1
8½ × 23½	55.7	3.6	58.8	1.9
11½ × 11½	38.4	3.8	42.4	2.1
11½ × 20½	55.9	3.1	57.7	1.6
14½ × 14½	49.8	3.1	51.5	1.6
14½ × 23½	67.7	2.6	70.3	1.4
17½ × 17½	61.9	2.6	64.5	1.4
17½ × 23½	73.5	2.3	77.2	1.2
20½ × 20½	73.3	2.3	76.4	1.2
23½ × 23½	79.1	1.9	91.1	1.1

It will be noted that the foregoing tables are based on an actual outside air temperature of 70°F. In practice, with any insulated duct, where the ducts usually run along a ceiling between floor joists or in a wall between studding, the temperature of the air surrounding the ducts is higher than 70°F. For this reason actual heat losses in duct systems are considerably less than those shown in the tables. Because of these conditions it was impractical to publish data based on any surrounding air temperatures other than 70°F.

THICKNESS TO PREVENT SWEATING

The term sweating is applied to the collecting of moisture on a cold surface. Sweating or condensation occurs when the temperature of the surface is below the dew point of the surrounding air. In any duct systems carrying cold air the temperature and humidity conditions through which any part of the system passes should be carefully considered. Enclosed basement spaces, laundry rooms, kitchens, pump rooms, etc., may have as high as 75% or even 80% relative humidity. In such spaces extra thickness of Careyduct may be required.

It is often necessary in air cooling installations to know the thickness of asbestos or insulation which will prevent sweating or condensation on the outer surface of the duct. Sweating will be prevented when the thickness of the duct is sufficient to raise the temperature of the outer surface to a point slightly higher than the dewpoint for the corresponding air temperature and relative humidity. The difference in temperature between the air and the dewpoint for various humidities can be readily taken from a psychrometric chart. Chart (A) gives temperature differences between the air and dewpoint for air temperatures of 30°F. to 100°F. and for relative humidities of 40 to 90 per cent.

The thickness of insulation required to prevent sweating will then be slightly greater than the value (L) obtained by solving the following equation.

$$L = k \; \frac{T_1 - T_3}{q} - \left(\frac{1}{f_o} + \frac{1}{f_i}\right)\Big] \qquad (3)$$

T_1 = temperature of air in room
T_2 = temperature of outer surface of duct or insulation
T_3 = temperature of cooler air in duct
q = heat loss per sq. ft. of outer surface of insulation, Btu. per hr.
f_i and f_o = film conductances inside and outside the duct respectively, Btu. per hr. per sq. ft. per °F.
k = conductivity of duct or insulation
L = thickness of duct or insulation

In any practical case T_1 and T_3 will be known, and, for any assumed value of relative humidity ($T_1 - T_2$) can be obtained from Chart (A). q, f_o and k, can be obtained from published surface heat transmission and thermal conductivity curves.

There is little reliable information on the value of f_i to be used for ducts as large as those used in air conditioning systems. However, for the velocities usually encountered in these systems, f_i will have little influence on the actual thickness required to prevent condensation. As mentioned before a value of $f_i = 4$ has been used in the calculations.

THICKNESS OF CAREYDUCT TO PREVENT SWEATING

TEMPERATURE DIFFERENCE BETWEEN AIR AND DEW POINT AT DIFFERENT RELATIVE HUMIDITIES

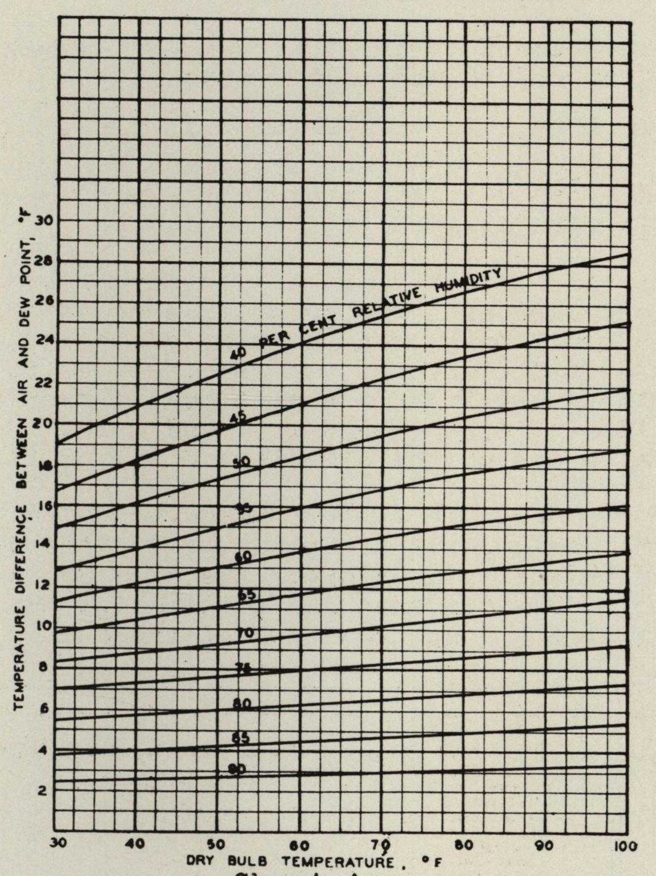


Chart A.

The following table has been prepared to enable engineers to quickly determine the proper thickness of Careyduct to use to prevent sweating when the outside air is actually at the temperature indicated. In practice, when the duct runs along a ceiling and between beams or wall studs, the temperature difference between the air inside and outside the duct becomes much less than is the case with the duct exposed on all sides. The actual temperature difference between the air inside and outside the duct should be used in reference to the table of thicknesses of Careyduct to prevent sweating.

THICKNESS OF CAREYDUCT TO PREVENT SWEATING

Per Cent Relative Humidity	Difference in Temperature Between Air Inside and Outside of Careyduct Duct Carrying Air at 50°F.						
	20°F.	25°F.	30°F.	35°F.	40°F.	45°F.	50°F.
60%	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"
70%	1/2"	3/4"	1"	1-1/4"	1-1/2"	1-1/2"	1-3/4"
80%	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	2-3/4"	3"

Careyduct

ASBESTOS INSULATED DUCT

FRICTION LOSSES

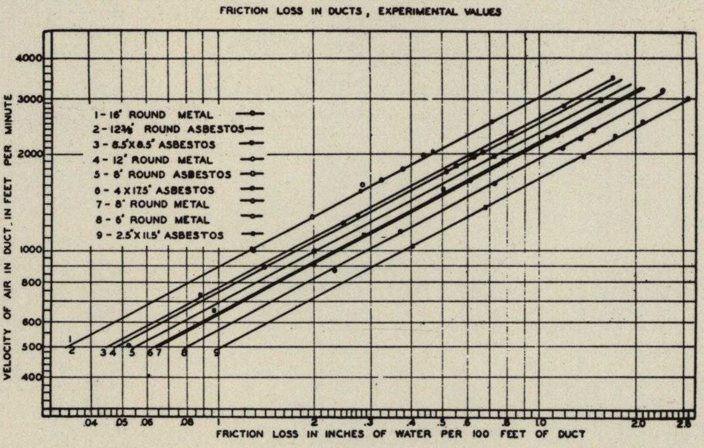
The smooth inner surfaces of Careyduct, the absence of irregularities at the joints of sections, and the use of duct vanes in fittings all combine to keep friction losses to a minimum.

Extensive laboratory tests of straight runs of Careyduct and galvanized metal duct showed no appreciable differences.

The use of data that results in satisfactory metal duct systems can also be made in designing Careyduct systems. The friction losses in Careyduct ells equipped with asbestos duct vanes are slightly less than in metal ells with a radius ratio of 1.5:1.

Investigation was made to determine the static pressure drops that obtain in metal and Careyduct for velocities up to 3000 ft. per min. To obtain this information over a range of diameters, the drop in static pressure for a distance of approximately 40 ft. was measured on Careyduct of the following cross-sectional dimensions: $2\frac{1}{2}$ in. x $11\frac{1}{2}$ in.; 4 in. x $17\frac{1}{2}$ in.; $8\frac{1}{2}$ in. x $8\frac{1}{2}$ in., and 8 in. x 12 in. round, and on round metal ducts of the diameters 6 in., 8 in., 12 in., and 16 in.

The Chart B plotted on logarithmic paper, gives the drop in static pressure obtained on the various ducts tested. The static pressure drop corrected to a 100-ft. length is plotted against the average velocity measured at the downstream end of the duct.



FRICTION LOSS IN 100 FEET OF DUCTS.

Chart B.

The A.S.H.V.E. Guide has included for several years a chart for obtaining the friction loss in metal ducts. This chart was calculated from the formula,

$$h_L = \frac{1.1\,L}{C D^{9/7}} \left(\frac{V}{4005}\right)^{33/7} \qquad (4)$$

where

h_L = loss of head, in. of water
L = length of pipe, ft.
V = velocity of air, ft. per min.
D = diameter of pipe, ft.
C = length of pipe in diameters for one head loss
C = 60 for perfectly smooth pipe, and 50 for heating and ventilating ducts

FRICTION LOSSES THROUGH CAREYDUCT
90 DEGREE VANED ELBOWS

This table gives approximate footages of straight Careyduct which will produce the same friction drop as one 90 degree vaned Careyduct elbow when this elbow is well downstream from obstructions or other causes of poor air distribution. All calculations are based on a loss of 25% of the velocity head per elbow.

Where reverse or double 90 degree elbows occur the friction should be doubled for the second elbow.

VELOCITY	800 F.P.M.		1000 F.P.M.		1200 F.P.M.		1400 F.P.M.		1600 F.P.M.	
Duct Size	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance
2½ x 5½	.25	4'	.40	4'	.56	4.0'	.74	4.1'	.95	4.2'
2½ x 8½	.21	4.8'	.33	4.7'	.46	4.9'	.60	5.1'	.78	5.1'
2½ x11½	.19	5.3'	.28	5.6'	.40	5.6'	.54	5.7'	.68	5.9'
2½ x14½	.17	5.9'	.26	6.0'	.37	6.0'	.48	6.4'	.62	6.5'
2½ x17½	.15	6.7'	.23	6.8'	.34	6.6'	.44	7.0'	.57	7.0'
2½ x20½	.15	6.7'	.22	7.1'	.32	7.0'	.42	7.3'	.54	7.4'
2½ x23½	.14	7.1'	.21	7.4'	.29	7.7'	.38	8.0'	.51	7.9'
4 x 5½	.20	5'	.31	5.0'	.44	5.1'	.58	5.3'	.75	5.3'
4 x 8½	.17	5.9'	.25	6.2'	.37	6.0'	.47	6.5'	.60	6.7'
4 x 11½	.14	7.1'	.22	7.1'	.32	7.0'	.41	7.5'	.54	7.4'
4 x 14½	.13	7.7'	.19	8.2'	.28	8.0'	.34	9.0'	.48	8.3'
4 x 17½	.12	8.3'	.18	8.7'	.26	8.6'	.33	9.3'	.44	9.1'
4 x 20½	.11	9.1'	.17	9.2'	.24	9.3'	.32	9.6'	.42	9.5'
4 x 23½	.11	9.1'	.16	9.7'	.23	9.7'	.30	10.2'	.38	10.5'
5½ x 5½	.17	5.9'	.26	6.0'	.37	6.0'	.48	6.4'	.63	6.4'
5½ x 8½	.14	7.1'	.22	7.1'	.30	7.5'	.39	7.8'	.52	7.7'
5½ x11½	.13	7.7'	.19	8.2'	.27	8.3'	.34	9.0'	.45	8.9'
5½ x14½	.11	8.3'	.17	9.2'	.23	9.7'	.31	9.9'	.39	10.3'
5½ x17½	.099	10.1'	.15	10.4'	.22	10.2'	.28	10.9'	.37	10.8'
5½ x20½	.092	10.9'	.14	11.1'	.20	11.2'	.27	11.3'	.33	12.1'
5½ x23½	.086	11.6'	.13	12.0'	.18	12.4'	.25	12.2'	.32	12.5'
8½ x 8½	.12	8.3'	.17	9.2'	.24	9.3'	.33	9.3'	.42	9.6'
8½ x11½	.096	10.4'	.14	11.1'	.21	10.7'	.28	10.9'	.37	10.8'
8½ x14½	.085	11.8'	.13	12.0'	.18	12.4'	.24	12.7'	.32	12.5'
8½ x17½	.076	13.2'	.12	13.0'	.17	13.2'	.23	13.3'	.28	14.3'
8½ x20½	.07	14.3'	.11	14.2'	.16	14.0'	.205	14.9'	.27	14.8'
8½ x23½	.066	15.2'	.10	15.6'	.14	16.0'	.18	17.0'	.25	16.0'
11½x11½	.082	12.2'	.13	12.0'	.18	12.4'	.23	13.3'	.30	13.3'
11½x14½	.074	13.5'	.12	13.0'	.16	14.0'	.21	14.6'	.27	14.8'
11½x17½	.066	15.2'	.099	15.8'	.14	16.0'	.18	17.0'	.24	16.7'
11½x20½	.062	16.1'	.094	16.6'	.13	17.2'	.17	18.0'	.23	17.4'
11½x23½	.060	16.7'	.086	18.2'	.13	17.2'	.165	18.6'	.22	18.2'
14½x14½	.065	15.4'	.096	16.3'	.15	14.9'	.18	17.0'	.24	16.7'
14½x17½	.058	17.2'	.087	18.0'	.13	17.2'	.17	18.0'	.22	18.2'
14½x20½	.054	18.5'	.082	19.0'	.12	18.7'	.16	19.1'	.20	20.0'
14½x23½	.050	20'	.076	20.5'	.11	20.4'	.14	21.9'	.18	22.2'.
17½x17½	.054	18.5'	.080	19.5'	.12	18.7'	.15	20.4'	.19	21.0'
17½x20½	.048	20.8'	.073	21.4'	.105	21.4'	.14	21.9'	.18	22.2'
17½x23½	.046	21.8'	.068	23.0'	.10	22.4'	.13	23.5'	.17	23.5'
20½x20½	.046	21.8'	.067	23.3'	.096	23.4'	.13	23.5'	.165	24.2'
20½x23½	.042	23.8'	.064	24.4'	.090	25.0'	.12	25.5'	.160	25.0'
23½x23½	.038	26.3'	.058	26.9'	.084	26.7'	.115	26.6'	.140	28.6'

Continued on Page 28b

Careyduct

ASBESTOS INSULATED DUCT

FRICTION LOSSES THROUGH CAREYDUCT 90 DEGREE VANED ELBOWS

Continued from Page 28a

This table gives approximate footages of straight Careyduct which will produce the same friction drop as one 90 degree vaned Careyduct elbow when this elbow is well downstream from obstructions or other causes of poor air distribution. All calculations are based on a loss of 25% of the velocity head per elbow.

Where reverse or double 90 degree elbows occur the friction should be doubled for the second elbow.

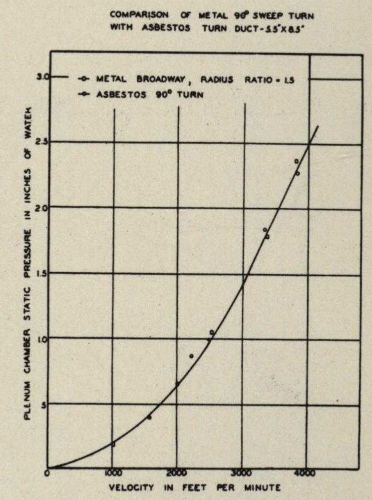
Velocity	1800 F.P.M.		2000 F.P.M.		2200 F.P.M.		2400 F.P.M.	
Duct Size	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance	Friction loss per hundred ft. of straight Careyduct in inches of water	No. of feet of straight duct for equivalent resistance
2½ x 5½	1.2	4.2'	1.40	4.5'	1.70	4.5'	1.95	4.6'
2½ x 8½	.95	5.3'	1.15	5.4'	1.35	5.6'	1.65	5.5'
2½ x11½	.82	6.2'	1.00	6.3'	1.20	6.3'	1.40	6.4'
2½ x14½	.75	6.8'	.90	7.0'	1.10	6.9'	1.30	6.9'
2½ x17½	.70	7.2'	.84	7.4'	1.00	7.6'	1.20	7.5'
2½ x20½	.65	7.8'	.79	7.9'	.94	8.1'	1.15	7.8'
2½ x23½	.62	8.2'	.74	8.5'	.89	8.5'	1.08	8.3'
4 x 5½	.92	5.5'	1.15	5.4'	1.30	5.8'	1.60	5.6'
4 x 8½	.74	6.8'	.88	7.1'	1.10	6.9'	1.30	6.9'
4 x 11½	.64	7.9'	.77	8.1'	.94	8.1'	1.15	7.8'
4 x 14½	.58	8.7'	.69	9.1'	.84	9.0'	.98	9.2'
4 x 17½	.52	9.7'	.65	9.6'	.78	9.7'	.92	9.8'
4 x 20½	.50	10.1'	.60	10.4'	.73	10.4'	.85	10.6'
4 x 23½	.48	10.5'	.57	11.0'	.68	11.1'	.80	11.3'
5½ x 5½	.78	6.5'	.93	6.7'	1.18	6.7'	1.30	6.9'
5½ x 8½	.63	8.0'	.74	8.5'	.90	8.4'	1.10	8.2'
5½ x11½	.54	9.4'	.65	9.6'	.78	9.7'	.92	9.8'
5½ x14½	.49	10.3'	.58	10.8'	.70	10.8'	.83	10.8'
5½ x17½	.45	11.3'	.54	11.6'	.64	11.8'	.76	11.8'
5½ x20½	.42	12.0'	.50	12.5'	.59	12.8'	.70	12.9'
5½ x23½	.39	13.0'	.47	13.3'	.57	13.3'	.67	13.4'
8½ x 8½	.50	10.1'	.60	10.4'	.73	10.4'	.85	10.6'
8½ x11½	.44	11.5'	.53	11.8'	.63	12.0'	.73	12.3'
8½ x14½	.38	13.3'	.47	13.3'	.55	13.8'	.65	13.8'
8½ x17½	.35	14.5'	.43	14.5'	.50	15.2'	.59	15.3'
8½ x20½	.33	15.3'	.38	16.5'	.47	16.1'	.55	16.4'
8½ x23½	.31	16.3'	.37	16.9'	.44	17.2'	.52	17.3'
11½x11½	.37	13.7'	.45	13.9'	.53	14.4'	.63	14.3'
11½x14½	.33	15.3'	.38	16.5'	.48	15.8'	.56	16.1'
11½x17½	.30	16.9'	.36	17.4'	.43	17.6'	.51	17.7'
11½x20½	.28	18.1'	.33	19.0'	.40	19.0'	.47	19.2'
11½x23½	.27	18.7'	.32	19.5'	.38	20.0	.44	20.5'
14½x14½	.29	17.4'	.35	17.9'	.42	18.0'	.50	18.0'
14½x17½	.27	18.8'	.32	19.5'	.38	20.0'	.45	20.0'
14½x20½	.25	20.2'	.29	21.6'	.35	21.6'	.43	21.0'
14½x23½	.23	22.0'	.28	22.3'	.33	23.0'	.38	23.7'
17½x17½	.24	21.1'	.285	22.0'	.345	22.0'	.41	22.0'
17½x20½	.23	22.0'	.27	23.2'	.335	22.6'	.38	23.7'
17½x23½	.215	23.5'	.255	24.5'	.30	25.2'	.35	25.7'
20½x20½	.20	25.3'	.245	25.5'	.29	26.1'	.345	26.2'
20½x23½	.19	26.6'	.23	27.2'	.28	27.0'	.325	27.7'
23½x23½	.18	28.1'	.22	28.4'	.26	29.1'	.300	30.0'

FRICTION LOSSES

If values of h_L for various velocities taken from Chart B are compared with calculated values of h_L from the equation above using $C = 50$, it is found that with the exception of the 12 in. and 16 in. round metal ducts the experimentally determined frictional resistances are somewhat lower than those obtained from this equation.

Chart B shows that the curves of velocity against pressure drop for the various duct sizes are parallel to each other and have a slope of approximately 1.87. This indicates that the pressure drops obtained vary directly within 1 per cent as $V^{13/7}$.

Contrary to what would be expected from the equation, the pressure drops did not vary inversely as $D^{5/4}$. There is considerable variation from this relationship for the different sizes of ducts, both round and rectangular.



PLENUM CHAMBER STATIC PRESSURE TO FEED AIR THROUGH 42 FT. OF 5½-IN. x 8½-IN. DUCT INCLUDING METAL AND ASBESTOS 90° ELLS.

Chart C.

The friction losses in elbows of various types were studied briefly. Chart C shows the relation between the plenum chamber static pressures necessary to drive air at the velocities given through 42 ft. of 5½ in. by 8½ in. Careyduct including the 90° elbows indicated. Eighteen feet of the duct formed a downstream leg for the turns. Careyduct elbows are equipped with directing vanes. The two elbows had losses of about 20 per cent of the velocity head. With the metal turn the losses are considerably higher without a downstream leg following the turn. This leg is not necessary with elbows equipped with vanes. Narrow way turns of high aspect ratio were found to be somewhat better than those of low aspect ratio. At 1200 ft. per min. velocity, a 4 in. x 17½ in. Careyduct 90° turn equipped with one turning vane, aspect ratio about 10, had a loss of 14 per cent of the velocity head, this loss increasing to 18 per cent at 2150 ft. per min. The corresponding loss in a broadway turn, effective aspect ratio about 3, was about 30 per cent.

The losses in turns and fittings depend to a large extent on their environment, and the same turn may have losses varying, as it did for one turn tested, from 17 to 85 per cent of the velocity head. It is believed that turns well downstream from obstructions or other causes of poor air distribution will always show minimum losses.

When the pressure drops obtained on Careyduct were plotted on rectangular coordinate paper against the reciprocal of 4 times the mean hydraulic radius it was found that a straight line could be drawn through the plotted points which had a maximum deviation of less than 8 per cent from any of the points. The same was found to be true for the round metal ducts, although the line obtained did not fall on the line obtained for Careyduct but was parallel to it.

Chart D was constructed from the above relationships of velocity and diameter or mean hydraulic radius.

Continued on Page 31

Careyduct

ASBESTOS INSULATED DUCT

CHART FOR CALCULATING FRICTION LOSS IN CAREYDUCT

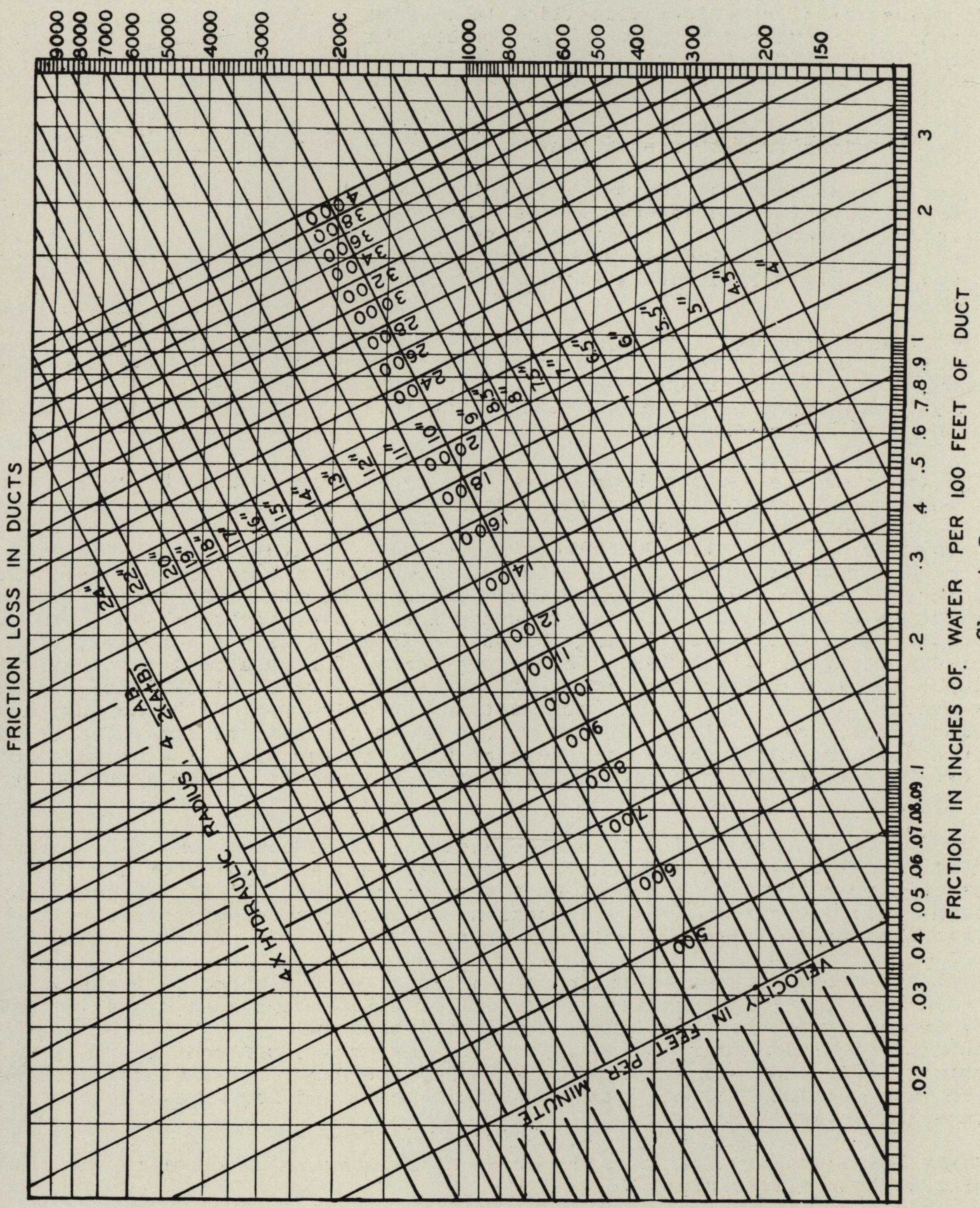


Chart D.

FRICTION LOSSES

EQUIVALENT DIAMETERS OF CAREYDUCT

Diameter of Round Careyduct which Gives Same Friction Losses Per Unit Length as the Corresponding Rectangular Careyduct At the Same Volume of Flow. (C.F.M.)

The following table gives the sizes of round Careyduct that have the same friction loss at the same volume of flow as the rectangular Careyduct indicated.

ONE SIDE REC'T CAREY-DUCT, INCHES ↓	OTHER SIDE OF RECTANGULAR CAREYDUCT, INCHES								
	2½	4	5½	8½	11½	14½	17½	20½	23½
	DIAMETER OF CIRCULAR CAREYDUCT HAVING THE SAME FRICTION LOSS AT THE SAME VOLUME OF FLOW								
2½	2.6	3.4	4.0	4.9	5.7	6.2	6.7	7.1	7.5
4	3.4	4.3	5.2	6.3	7.2	8.0	8.7	9.3	9.8
5½	4.0	5.2	6.1	7.4	8.6	9.6	10.5	11.3	12.0
8½	4.9	6.3	7.4	9.3	10.8	12.2	13.4	14.4	15.2
11½	5.7	7.2	8.6	10.8	12.7	14.2	15.5	16.7	17.7
14½	6.2	8.0	9.6	12.2	14.2	15.9	17.4	18.8	20.0
17½	6.7	8.7	10.5	13.4	15.5	17.4	19.1	20.7	22.1
20½	7.1	9.3	11.3	14.4	16.7	18.8	20.7	22.5	24.2
23½	7.5	9.8	12.0	15.2	17.7	20.0	22.1	24.2	26.0

EXAMPLE - A

GIVEN - 1000 C. F. M. Required.
- Max. allowable friction .15" water per 100 ft.

FIND -- Velocity
-- Diameter of round Careyduct.
-- Equivalent rectangular Careyduct.

1 -- Locate 1000 C. F. M. at right hand margin. (chart on Page 30)

2 -- Locate .15" water at bottom of chart (vertical line).

3 -- Follow the 1000 C. F. M. line until it intersects the .15" water line. This intersection falls between the 1100 and 1200 F. P. M. velocity lines which are the lines sloping to the left. The velocity indicated is about 1110 F. P. M.

4 -- The diameter of round Careyduct indicated by the lines sloping to the right is about 12.8.

5 -- The nearest (12.7) equivalent rectangular Careyduct shown in the table is 11½ x 11½.

CAREYDUCT AREA TABLES

(all dimensions are based on inside measurements)

Cross Sect. Area Sq. Ft.	Cross Sect. Area Sq. In.	"Careyduct" Size	Cross Sect. Area Sq. Ft.	Cross Sect. Area Sq. In.	"Careyduct" Size
.095	14	2½ x 5½	.783	113	5½ x 20½
.148	21	2½ x 8½	.855	123	8½ x 14½
.168	22	4 x 5½	.896	129	5½ x 23½
.200	29	2½ x 11½	.920	132	11½ x 11½
.210	30	5½ x 5½	1.034	149	8½ x 17½
.236	34	4 x 8½	1.160	167	11½ x 14½
.252	36	2½ x 14½	1.210	174	8½ x 20½
.304	44	2½ x 17½	1.390	200	8½ x 23½
.319	46	4 x 11½	1.399	201	11½ x 17½
.344	47	5½ x 8½	1.459	210	14½ x 14½
.356	51	2½ x 20½	1.639	236	11½ x 20½
.403	58	4 x 14½	1.762	254	14½ x 17½
.408	59	2½ x 23½	1.875	270	11½ x 23½
.439	63	5½ x 11½	2.062	297	14½ x 20½
.486	70	4 x 17½	2.122	306	17½ x 17½
.502	72	8½ x 8½	2.362	341	14½ x 23½
.553	80	5½ x 14½	2.490	359	17½ x 20½
.570	82	4 x 20½	2.860	411	17½ x 23½
.653	94	4 x 23½	2.920	420	20½ x 20½
.668	96	5½ x 17½	3.350	482	20½ x 23½
.679	98	8½ x 11½	3.840	552	23½ x 23½

"Careyduct" Size	Cross Sect. Area Sq. Ft.	Cross Sect. Area Sq. In.	"Careyduct" Size	Cross Sect. Area Sq. Ft.	Cross Sect. Area Sq. In.
2½ x 5½	.095	14	8½ x 8½	.502	72
2½ x 8½	.148	21	8½ x 11½	.679	98
2½ x 11½	.200	29	8½ x 14½	.855	123
2½ x 14½	.252	36	8½ x 17½	1.034	149
2½ x 17½	.304	44	8½ x 20½	1.210	174
2½ x 20½	.356	51	8½ x 23½	1.390	200
2½ x 23½	.408	59	11½ x 11½	.920	132
4 x 5½	.168	22	11½ x 14½	1.160	167
4 x 8½	.236	34	11½ x 17½	1.399	201
4 x 11½	.319	46	11½ x 20½	1.639	236
4 x 14½	.403	58	11½ x 23½	1.875	270
4 x 17½	.486	70	14½ x 14½	1.459	210
4 x 20½	.570	82	14½ x 17½	1.762	254
4 x 23½	.653	94	14½ x 20½	2.062	297
5½ x 5½	.210	30	14½ x 23½	2.362	341
5½ x 8½	.344	47	17½ x 17½	2.122	306
5½ x 11½	.439	63	17½ x 20½	2.490	359
5½ x 14½	.553	80	17½ x 23½	2.860	411
5½ x 17½	.668	96	20½ x 20½	2.920	420
5½ x 20½	.783	113	20½ x 23½	3.350	482
5½ x 23½	.896	129	23½ x 23½	3.840	552

SOUND CHARACTERISTICS

The attenuation of sound in metal and Careyduct of various sizes and shapes has been measured by "practical" methods. All the data considered desirable for proper evaluation of the attenuation in ducts of all dimensions have not as yet been obtained, and the following results are to be considered only indicative of general behavior.

The most important sound reduction is that in ducts with air flowing through them. The attenuation of sound in a duct may be measured for any sound frequency, but the attenuation of sound caused by the fan and the air flow cannot be evaluated from data obtained by the use of fixed frequencies without knowledge of the frequency distribution in air and fan sound, and this only when no sound is created in the duct and fittings. It is doubtful that the latter condition is ever met in ducts with appreciable air flow.

The curves of Chart E show the drop in average sound level from the plenum chamber to a room connected therto with 76 ft. of Careyduct and metal ducts of the sizes given. The drops in sound level are based on an average level in the plenum chamber of 90 decibels, and in view of the fact that there is attenuation of sound at the inlet and outlet of the ducts, as well as in the ducts, the drops in sound level are to be considered of comparative value only. The drops are of course indicative of those to be expected in practice under the same conditions, but it should be noted that rooms are rarely, if ever, conditioned with air at the higher velocities in the figure or by straight runs of ducts containing no fittings or other sound absorbing units, and that therefore the high levels at the outlet are not to be expected in practice.

The drops in sound intensity through Careyduct of all sizes are higher than those through the corresponding metal ducts, and the improvement is substantially constant up to velocities of 3500 F. P. M. At a velocity of 1000 F. P. M., the sound levels obtained at the outlet of the ducts were lower with Careyduct than with Metal ducts by the following amounts: 11 in. x 13 in. ducts, 6.0 decibels; 5½ in. x 8½ in., 5.7 decibels; and 2½ in. x 11 in., 8.8 decibels. For the intensity levels given in Chart E at a velocity of 1000 ft. per min., the apparent loudness in the room was,

11 in. x 13 in. Careyduct loudness about 65 per cent of that with metal duct
5½ in. x 8½ in. Careyduct loudness about 60 per cent of that with metal duct
2½ in. x 11½ in. Careyduct loudness about 40 per cent of that with metal duct

SOUND CHARACTERISTICS

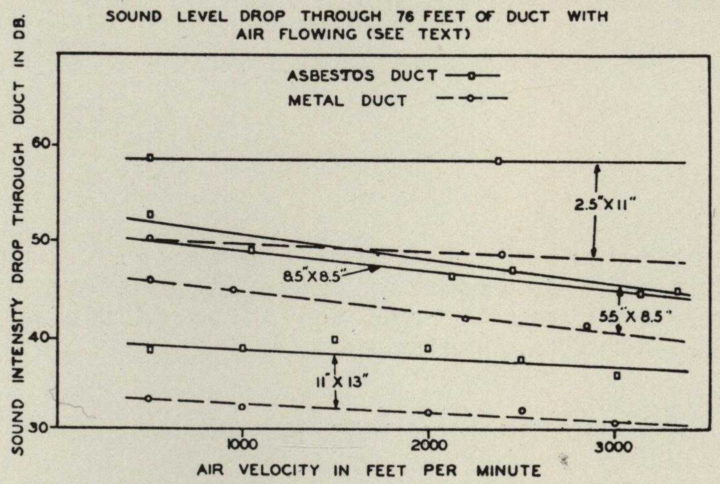


Chart E. COMPARISON OF SOUND INTENSITY DROP THROUGH 76 FT. OF ASBESTOS AND METAL DUCTS.

ATTENUATION OF SOUND

Inside Careyduct dimensions, in.	Attenuation of sound in decibels per linear foot of Careyduct at the sound frequencies, cycle per second		
	500	1000	2000
$2\frac{1}{2}$ x $11\frac{1}{2}$	.25	.33	.33
4 x $17\frac{1}{2}$	.11	.14	.30
$8\frac{1}{2}$ x $8\frac{1}{2}$	.18	.25	.31

For the frequencies given, the attenuation is greater for the higher frequencies, as is to be expected.

Fittings will in general contribute to the reduction of sound. A Careyduct 90° elbow of inside dimensions $5\frac{1}{2}$ in. x $8\frac{1}{2}$ in. attenuated sound of frequencies 250, 500 and 1000 cycles 7, 11, and 14 decibels, respectively, more than a metal elbow of the same cross-section and of radius ratio 1.5, the metal elbow reducing the sound practically not at all. An $8\frac{1}{2}$ in. x $8\frac{1}{2}$ in. Careyduct elbow reduced the sound 7.8, 7.2 and 12.2 decibels at the respective frequencies. With air flow, the $5\frac{1}{2}$ in. x $8\frac{1}{2}$ in. Careyduct elbow reduced sound at the outlet 4 and 7 decibels more than the metal at 500 and 1000 F. P. M. At ordinary velocities valuable sound reduction may be expected from Careyduct systems containing several fittings.

There are no appreciable resonance effects with Careyduct and sound pickup from the environment, and particularly the transmission of such sound, is much less than in metal duct.

TIME FOR CONSTRUCTION OF FITTINGS

The following data represent what may be expected from a mechanic EXPERIENCED in handling Careyduct. These figures are not guaranteed and represent only what can be expected after sufficient experience has been gained in handling Careyduct.

CONSTRUCTION TIME FOR ELBOWS

For 11½" x 11½" - 90° Elbow including Duct Vanes, Fastening, and Taping........... 25 Minutes

For 5½" x 11½" - 45° Narrow Way Elbow................ 10 Minutes

For 5½" x 11½" - 60° Narrow Way Elbow................ 10 Minutes

For 5½" x 11½" - 45° Broad Way Elbow................. 10 Minutes

NOTE: 30° - 45° - 60° Elbows, Broad Way or Narrow Way, Do not require Duct Vanes.

CONSTRUCTION TIME FOR STACKHEADS

For 2½" x 11½" Riser to 5½" x 11½" Outlet............. 20 Minutes
This includes all cuts necessary for two stackheads

Stackheads do not require duct vanes.

For Increasing Elbow 5½" x 5½" increasing to 5½ x 11½"
90° Ell assembled with Vanes, Broad Way Type. 25 Minutes

ACCESSORY DATA FOR BROADWAY ELBOWS

Size	No. Vanes	Vane Length	Total in. Vane Req'd	No. Clips (Pairs)	No. Fasteners	Ft. of Tape per Elbow	
						½" thick	1" thick
2½ x 5½	2	2½	5"	2	4	3-1/2	4
2½ x 8½	3	2½	7½"	3	6	4-1/4	4-3/4
2½ x 11½	5	2½	12½"	5	6	5	5-1/2
2½ x 14½	6	2½	15"	6	8	5-3/4	6
2½ x 17½	7	2½	17½"	7	8	6-1/4	6-3/4
2½ x 20½	8	2½	20"	8	10	7	7-1/2
2½ x 23½	10	2½	25"	10	12	7-3/4	8-1/4
4 x 5½	2	4	8"	2	4	3-3/4	4-1/4
4 x 8½	3	4	12"	3	6	4-1/2	5
4 x 11½	5	4	20"	5	6	5-1/4	5-3/4
4 x 14½	6	4	24"	6	8	6	6-1/2
4 x 17½	7	4	28"	7	8	6-1/2	7
4 x 20½	8	4	32"	8	10	7-1/4	7-3/4
4 x 23½	10	4	40"	10	12	8	8-1/2
5½ x 5½	2	5½	11"	2	4	4	4-1/2
5½ x 8½	3	5½	17"	3	6	4-3/4	5-1/4
5½ x 11½	5	5½	28"	5	6	5-1/2	6
5½ x 14½	6	5½	33"	6	8	6-1/4	6-1/2
5½ x 17½	7	5½	39"	7	8	6-3/4	7-1/4
5½ x 20½	8	5½	44"	8	10	7-1/2	8
5½ x 23½	10	5½	55"	10	12	8-1/4	8-3/4
8½ x 8½	3	8½	26"	3	6	5-1/4	5-3/4
8½ x 11½	5	8½	43"	5	6	6	6-1/2
8½ x 14½	6	8½	51"	6	8	6-3/4	7
8½ x 17½	7	8½	60"	7	8	7-1/4	7-3/4
8½ x 20½	8	8½	68"	8	10	8	8-1/2
8½ x 23½	10	8½	85"	10	12	8-3/4	9-1/4
11½ x 11½	5	11½	58"	5	6	6-1/2	7
11½ x 14½	6	11½	69"	6	8	7-1/4	7-1/2
11½ x 17½	7	11½	81"	7	8	7-3/4	8-1/4
11½ x 20½	8	11½	92"	8	10	8-1/2	9
11½ x 23½	10	11½	115"	10	12	9-1/4	9-3/4
14½ x 14½	6	14½	87"	6	8	7-3/4	8
14½ x 17½	7	14½	102"	7	8	8-1/4	8-3/4
14½ x 20½	8	14½	116"	8	10	9	9-1/2
14½ x 23½	10	14½	145"	10	12	9-3/4	10-1/4
17½ x 17½	7	17½	123"	7	8	8-3/4	9-1/4
17½ x 20½	8	17½	140"	8	10	9-1/2	10
17½ x 23½	10	17½	175"	10	12	10-1/4	10-3/4
20½ x 20½	8	20½	164"	8	10	10	10-1/2
20½ x 23½	10	20½	205"	10	12	10-3/4	11-1/4
23½ x 23½	10	23½	235"	10	12	11-1/4	11-3/4

Careyduct

ASBESTOS INSULATED DUCT

ACCESSORY DATA FOR NARROW WAY ELBOWS

Size	No. Vanes	Vane Length	Total in. Vane Req'd	No. Clips (Pairs)	No. Fasteners	Ft. of Tape per Elbow	
						½" thick	1" thick
2½ x 5½	1	5½	6	1	4	3-1/4	3-3/4
2½ x 8½	1	8½	9	1	4	3-3/4	4-1/4
2½ x 11½	1	11½	12	1	4	4-1/4	4-3/4
2½ x 14½	1	14½	15	1	4	4-3/4	5-1/4
2½ x 17½	1	17½	18	1	4	5-1/4	5-3/4
2½ x 20½	1	20½	21	1	4	5-3/4	6-1/4
2½ x 23½	1	23½	24	1	4	6-1/4	6-3/4
4 x 5½	1 or 2	5½	11	2	4	3-3/4	4
4 x 8½	1 or 2	8½	17	2	4	4-1/4	4-1/2
4 x 11½	1 or 2	11½	23	2	4	4-3/4	5
4 x 14½	1 or 2	14½	29	2	4	5-1/4	5-1/2
4 x 17½	1 or 2	17½	35	2	4	5-3/4	6
4 x 20½	1 or 2	20½	41	2	4	6-1/4	6-1/2
4 x 23½	1 or 2	23½	47	2	4	6-3/4	7
5½ x 5½	2	5½	11	2	4	4	4-1/2
5½ x 8½	2	8½	17	2	4	4-1/2	5
5½ x 11½	2	11½	23	2	4	5	5-1/2
5½ x 14½	2	14½	29	2	4	5-1/2	6
5½ x 17½	2	17½	35	2	4	6	6-1/2
5½ x 20½	2	20½	41	2	4	6-1/2	7
5½ x 23½	2	23½	47	2	4	7	7-1/2
8½ x 8½	3	8½	26	3	6	5-1/4	5-3/4
8½ x 11½	3	11½	35	3	6	5-3/4	6-1/4
8½ x 14½	3	14½	44	3	6	6-1/4	6-3/4
8½ x 17½	3	17½	53	3	6	6-3/4	7-1/4
8½ x 20½	3	20½	62	3	6	7-1/4	7-3/4
8½ x 23½	3	23½	71	3	6	7-3/4	8-1/4
11½ x 11½	5	11½	58	5	6	6-1/2	7
11½ x 14½	5	14½	73	5	6	7	7-1/2
11½ x 17½	5	17½	88	5	6	7-1/2	8
11½ x 20½	5	20½	103	5	6	8	8-1/2
11½ x 23½	5	23½	118	5	6	8-1/2	9
14½ x 14½	6	14½	87	6	8	7-3/4	8
14½ x 17½	6	17½	105	6	8	8-1/4	8-1/2
14½ x 20½	6	20½	123	6	8	8-3/4	9
14½ x 23½	6	23½	141	6	8	9-1/4	9-1/2
17½ x 17½	7	17½	123	7	8	8-3/4	9-1/4
17½ x 20½	7	20½	144	7	8	9-1/4	9-3/4
17½ x 23½	7	23½	165	7	8	9-3/4	10-1/4
20½ x 20½	8	20½	164	8	10	10	10-1/2
20½ x 23½	8	23½	188	9	10	10-1/2	11
23½ x 23½	10	23½	235	10	12	11-1/4	11-3/4

CAREYDUCT CARTON PACKING DATA

The weights given in the table below are subject to some variation, but represent averages from which fairly accurate estimates can be made. These weights are not guaranteed.

ALL DIMENSIONS ARE INSIDE DUCT DIMENSIONS

1/2 inch thick Careyduct					1 inch thick Careyduct				
Size of Duct	Cross sec. area in sq. in. based on inside measurements.	Lineal ft. per cart.	Approx. Wt.-lbs. per cart.	Carton mark	Size of Duct	Cross sec. area in sq. in. based on inside measurements	Lineal ft. per cart.	Approx. Wt.-lbs. per cart.	Carton mark
2½ x 5½	13-3/4	24	75	A	2½ x 5½	13-3/4	18	87	A
2½ x 8½	21-1/4	18	77	C	2½ x 8½	21-1/4	12	80	F
2½ x 11½	28-3/4	12	66	A	2½ x 11½	28-3/4	9	76	A
2½ x 14½	36-1/4	21	138	E	2½ x 14½	36-1/4	9	92	A
2½ x 17½	43-3/4	12	94	B	2½ x 17½	43-3/4	9	109	B
2½ x 20½	51-1/4	9	81	D	2½ x 20½	51-1/4	6	84	D
2½ x 23½	58-3/4	12	121	E	2½ x 23½	58-3/4	9	140	E
4 x 5½	22	18	67	A	4 x 5½	22	12	69	A
4 x 8½	34	12	59	C	4 x 8½	34	9	69	C
4 x 11½	46	9	55	A	4 x 11½	46	6	57	A
4 x 14½	58	9	66	B	4 x 14½	58	9	101	B
4 x 17½	70	6	51	C	4 x 17½	70	6	79	E
4 x 20½	82	6	59	D	4 x 20½	82	6	90	E
4 x 23½	94	6	65	D	4 x 23½	94	6	100	E
5½ x 5½	30-1/4	18	78	F	5½ x 5½	30-1/4	18	119	E
5½ x 8½	46-3/4	9	50	C	5½ x 8½	46-3/4	9	76	D
5½ x 11½	63-1/4	9	60	F	5½ x 11½	63-1/4	6	62	A
5½ x 14½	79-3/4	6	48	A	5½ x 14½	79-3/4	6	74	B
5½ x 17½	96-1/4	6	55	F	5½ x 17½	96-1/4	6	85	E
5½ x 20½	112-3/4	6	62	F	5½ x 20½	112-3/4	6	95	E
5½ x 23½	129-1/4	6	69	E	5½ x 23½	129-1/4	6	105	F
8½ x 8½	72-1/4	6	41	C	8½ x 8½	72-1/4	6	63	D
8½ x 11½	97-3/4	6	48	F	8½ x 11½	97-3/4	6	73	F
8½ x 14½	123-1/4	6	56	B	8½ x 14½	123-1/4	3	43	A
8½ x 17½	148-3/4	3	32	C	8½ x 17½	148-3/4	3	49	C
8½ x 20½	174-1/4	3	36	D	8½ x 20½	174-1/4	3	54	D
8½ x 23½	199-3/4	3	40	D	8½ x 23½	199-3/4	3	60	E
11½ x 11½	132-1/4	12	109	G	11½ x 11½	132-1/4	3	43	A
11½ x 14½	166-3/4	3	32	A	11½ x 14½	166-3/4	3	48	A
11½ x 17½	201-1/4	3	36	F	11½ x 17½	201-1/4	3	54	F
11½ x 20½	235-3/4	5	40	F	11½ x 20½	235-3/4	3	60	E
11½ x 23½	270-1/4	3	43	E	11½ x 23½	270-1/4	3	65	E
14½ x 14½	210-1/4	3	37	B	14½ x 14½	210-1/4	3	55	B
14½ x 17½	253-3/4	3	40	B	14½ x 17½	253-3/4	3	60	B
14½ x 20½	297-1/4	3	43	E	14½ x 20½	297-1/4	3	67	G
14½ x 23½	340-3/4	3	49	G	14½ x 23½	340-3/4	3	73	G
17½ x 17½	306-1/4	3	46	G	17½ x 17½	306-1/4	3	67	G
17½ x 20½	358-3/4	3	49	G	17½ x 20½	358-3/4	3	73	G
17½ x 23½	411-1/4	3	53	G	17½ x 23½	411-1/4	3	78	G
20½ x 20½	420-1/4	3	53	G	20½ x 20½	420-1/4	3	78	G
20½ x 23½	481-3/4	3	56	G	20½ x 23½	481-3/4	3	83	G
23½ x 23½	552-1/4	3	59	G	23½ x 23½	552-1/4	3	88	G

SIZE OF CAREYDUCT CARTONS

Carton Mark

A - 16-11/16 x 13-11/16 x 36-3/16
B - 19-3/8 x 16-11/16 x 36-3/16
C - 20-1/16 x 11-1/16 x 36-3/16
D - 24-11/16 x 10-11/16 x 36-3/16
E - 25-11/16 x 15-3/8 x 36-3/16
F - 21-11/16 x 13-11/16 x 36-3/16
G - 25-11/16 x 25-11/16 x 36-3/16

A 40'-10 car holds approximately 438 average cartons of Careyduct.

Careyduct

ASBESTOS INSULATED DUCT

LIST PRICES OF CAREYDUCT

ECONOMY

With all its other advantages and improved performances over metal ducts, Careyduct is actually lower in first erected cost than properly insulated and well constructed metal ducts of the same size. Add to this the fact that Careyduct systems can be materially reduced in size, often to one-half (minimum air velocity of 1000 ft. per minute), and a very substantial saving can be made both in cost and in space.

(All Dimensions are Inside Duct Dimensions)

LIST PRICES PER LINEAL FOOT

1/2-INCH THICKNESS		1-INCH THICKNESS	
Size	Price	Size	Price
2-1/2" x 5-1/2"	$0.64	2-1/2" x 5-1/2"	$0.72
2-1/2" x 8-1/2"	.74	2-1/2" x 8-1/2"	.85
2-1/2" x 11-1/2"	.81	2-1/2" x 11-1/2"	.97
2-1/2" x 14-1/2"	.97	2-1/2" x 14-1/2"	1.17
2-1/2" x 17-1/2"	1.13	2-1/2" x 17-1/2"	1.36
2-1/2" x 20-1/2"	1.29	2-1/2" x 20-1/2"	1.56
2-1/2" x 23-1/2"	1.45	2-1/2" x 23-1/2"	1.75
4" x 5-1/2"	.56	4" x 5-1/2"	.68
4" x 8-1/2"	.73	4" x 8-1/2"	.88
4" x 11-1/2"	.89	4" x 11-1/2"	1.07
4" x 14-1/2"	1.05	4" x 14-1/2"	1.27
4" x 17-1/2"	1.21	4" x 17-1/2"	1.46
4" x 20-1/2"	1.37	4" x 20-1/2"	1.66
4" x 23-1/2"	1.53	4" x 23-1/2"	1.85
5-1/2" x 5-1/2"	.65	5-1/2" x 5-1/2"	.78
5-1/2" x 8-1/2"	.81	5-1/2" x 8-1/2"	.97
5-1/2" x 11-1/2"	.97	5-1/2" x 11-1/2"	1.17
5-1/2" x 14-1/2"	1.13	5-1/2" x 14-1/2"	1.36
5-1/2" x 17-1/2"	1.29	5-1/2" x 17-1/2"	1.56
5-1/2" x 20-1/2"	1.45	5-1/2" x 20-1/2"	1.75
5-1/2" x 23-1/2"	1.62	5-1/2" x 23-1/2"	1.95
8-1/2" x 8-1/2"	.97	8-1/2" x 8-1/2"	1.17
8-1/2" x 11-1/2"	1.13	8-1/2" x 11-1/2"	1.36
8-1/2" x 14-1/2"	1.29	8-1/2" x 14-1/2"	1.56
8-1/2" x 17-1/2"	1.45	8-1/2" x 17-1/2"	1.75
8-1/2" x 20-1/2"	1.62	8-1/2" x 20-1/2"	1.95
8-1/2" x 23-1/2"	1.78	8-1/2" x 23-1/2"	2.14
11-1/2" x 11-1/2"	1.29	11-1/2" x 11-1/2"	1.56
11-1/2" x 14-1/2"	1.45	11-1/2" x 14-1/2"	1.75
11-1/2" x 17-1/2"	1.62	11-1/2" x 17-1/2"	1.95
11-1/2" x 20-1/2"	1.78	11-1/2" x 20-1/2"	2.14
11-1/2" x 23-1/2"	1.94	11-1/2" x 23-1/2"	2.34
14-1/2" x 14-1/2"	1.62	14-1/2" x 14-1/2"	1.95
14-1/2" x 17-1/2"	1.78	14-1/2" x 17-1/2"	2.14
14-1/2" x 20-1/2"	1.94	14-1/2" x 20-1/2"	2.34
14-1/2" x 23-1/2"	2.10	14-1/2" x 23-1/2"	2.53
17-1/2" x 17-1/2"	1.94	17-1/2" x 17-1/2"	2.34
17-1/2" x 20-1/2"	2.10	17-1/2" x 20-1/2"	2.53
17-1/2" x 23-1/2"	2.26	17-1/2" x 23-1/2"	2.73
20-1/2" x 20-1/2"	2.26	20-1/2" x 20-1/2"	2.73
20-1/2" x 23-1/2"	2.42	20-1/2" x 23-1/2"	2.92
23-1/2" x 23-1/2"	2.59	23-1/2" x 23-1/2"	3.12

All CAREYDUCT furnished only in 3 foot long sections. For LIST PRICES for thicknesses greater than 1" add to the 1" thick LIST PRICES the differentials between 1/2" and 1" thicknesses shown in tables for each 1/2" increased thickness or fraction thereof.

LIST PRICES FOR ACCESSORIES

Duct Vanes	$0.30 per 3 ft. long section
Careyduct Adhesive 1 gal. tin Pail	1.00 per pail
Careyduct Adhesive 5 gal. tin Pail	3.75 per pail
Fasteners	.80 per 100 pieces
Duct Vane Clips (No. 1 and No. 2 always used in pairs)	4.00 per 100 pair
Cloth Adhesive Tape	2.45 per 100 yards

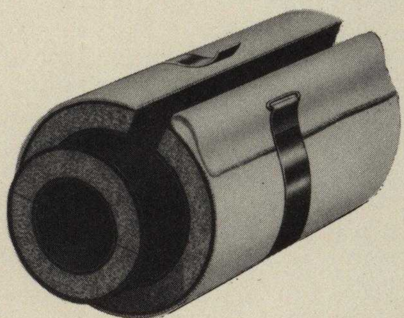
ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PIPE COVERING FOR AIR CONDITIONING

Two important functions of Heat Insulation in Air-Conditioning systems are the prevention of condensation on pipes and ducts, and the prevention of Heat Transmission to or from the surrounding atmosphere.

The following Carey Insulations are designed to perform these two functions and also to render efficient and long service.

CAREY IMPERVO (Anti-Sweat) COVERING FOR ICE WATER PIPES



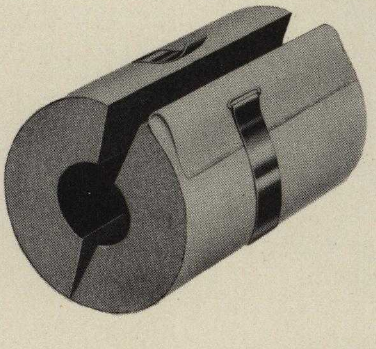
Designed for use on ice water and cold water pipes to keep water cold and prevent sweating. Carey Impervo Covering is composed of best quality insulating felt with waterproof felt liners and jackets applied to each layer. Furnished in sections 3 ft. long, canvas covered, with bands for applying for all pipe sizes. Regularly made in double 1/2 in. and double 3/4 in. thicknesses. Other thicknesses to order.

In general two layers of 1/2 in. thickness (total thickness 1 in.) should be used for cold water lines having a temperature not less than 50°F. and two layers 3/4 in. thick (total thickness 1-1/2") should be used for ice water lines having a temperature not lower than 40°F. Double layer construction should always be used with joints and seams staggered. It is important to keep air away from the pipes, and great care should be used in applying the coverings and building up the fittings to make the insulation air tight.

Table below shows the proper thickness to prevent sweating for various differences of temperature between air and water in the pipe and for various degrees of humidity.

Humidity	Temp. Diff. °F. 50° F. Max., in.	60° F. Max., in.	70° F. Max., in.
Up to 70%	1	1	1½
70% to 80%	1½	2	2
80% to 85%	2	2½	3

CAREY PERFECTO (Wool-Felt) COVERING FOR COLD OR HOT WATER PIPES



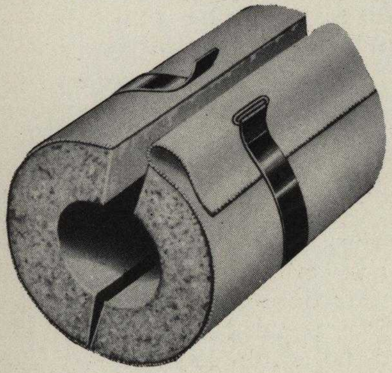
Designed to provide inexpensive insulation for cold water pipes and gives fair results in preventing sweating or freezing. Perfecto pipe covering consists of laminations of insulating felt with an All Service liner suitable for hot or cold pipes.

Furnished in 36-in. long sections, with cotton duck jackets and bands, in ½, 3/4, 1 in. double 1/2 in. and double 3/4 in. thicknesses.

PIPE COVERING
FOR AIR CONDITIONING

PIPE COVERING FOR AIR CONDITIONING

CAREY 85% MAGNESIA FOR HIGH AND MEDIUM PRESSURE STEAM SURFACES
200°F to 600°F



Specifically designed to furnish the highest quality molded heat insulation for medium and high pressure steam surfaces. Should not be used above 550°F.--600°F.

Carey 85% Magnesia is a molded composition of not less than 85% basic carbonate of magnesia and approximately 15% asbestos fibre. It is the accepted quality standard for high and low pressure work where maximum permanent efficiency is desired.

Furnished in sections and segments for covering pipes. Flat block furnished in standard sizes of 6 x 36 in., 6 x 18 in. and 3 x 18 in. in thicknesses from 7/8 to 4 in. Curved blocks (for 30 to 96 in. diameters) furnished in 6-in. width and lengths up to 42 in. Dry powder or cement for irregular surfaces.

For data on efficiency of Carey 85% Magnesia as a guide to selecting the proper thickness of pipe covering see table below.

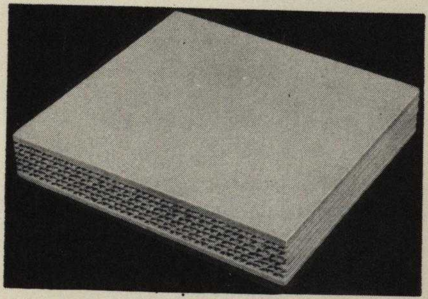
The term "efficiency" as used in connection with pipe covering means the per cent of reduction of heat loss from bare pipes by the use of pipe covering; i.e., the saving expressed in per cent of bare pipe loss. Example: A given length of bare steam piping loses the equivalent of 100 lbs. of coal per hour. A pipe covering having an efficiency of 85 per cent and used over this pipe would save 85 lbs. of coal per hour.

Steam Pressure			Hot Water		10 lbs.		80 lbs.		120 lbs.		160 lbs.		200 lbs.		200 lbs. and 100° F. Superheat		275 lbs. and 250° F. Superheat	
Steam Temperature °F. / Temperature Difference °F.			180° F. / 100° F.		239.4° F. / 159.4° F.		324.0° F. / 244.0° F.		350.0° F. / 270.0° F.		370.7° F. / 290.7° F.		387.9° F. / 307.9° F.		487.9° F. / 407.9° F.		664.3° F. / 584.3° F.	
Insulation Material	Thickness, in.	Pipe Size, in.	% Eff.	Loss	% Eff.	Loss	% Eff.	Loss	% Eff.	Loss	% Eff.	Loss	% Eff.	Loss	% Eff.	Loss	% Eff.	Loss
85% Magnesia	Std.	3	79.9	40.7	81.7	67.3	83.8	108.5	84.4	122.0	84.9	133.0	85.3	142.3	87.1	200.0	89.7	314.0
		6	82.4	64.3	84.1	105.7	86.1	169.5	86.7	190.4	87.1	207.5	87.3	222.0	89.1	308.8	91.3	482.0
		12	86.5	90.3	87.9	148.7	89.4	239.0	89.8	268.2	90.1	291.7	90.5	311.0	91.6	437.0	93.9	634.0
	1½	3	84.1	32.0	85.6	52.6	87.3	84.7	87.9	94.8	88.3	103.2	88.6	110.5	90.0	153.7	92.1	239.6
		6	85.7	52.3	87.1	86.0	88.7	137.6	89.2	154.5	89.5	168.1	89.8	179.2	91.2	249.5	93.1	387.0
		12	86.7	89.1	87.9	147.8	89.4	239.0	89.8	268.5	90.1	293.5	90.4	313.5	91.7	438.0	93.5	687.0
	2	3	86.9	26.5	88.1	43.7	89.6	69.8	90.1	78.6	90.3	85.8	90.5	91.4	91.9	125.5	93.6	196.4
		6	88.5	41.6	89.7	68.6	91.0	109.8	91.3	123.1	91.7	134.0	91.9	143.2	92.9	198.6	94.5	307.0
		12	89.1	73.0	90.5	116.4	91.5	192.5	91.9	216.0	92.2	235.2	92.3	251.0	93.3	350.0	94.8	543.0
	3	3	89.5	21.1	90.5	34.7	91.7	55.6	92.1	62.4	92.3	68.0	92.5	72.7	93.4	86.0	94.9	156.6
		6	91.1	32.5	92.0	53.4	92.9	85.4	93.3	95.8	93.5	104.0	93.7	111.0	94.5	153.7	95.7	235.0
		12	92.0	53.5	92.8	88.1	93.7	141.3	94.0	158.2	94.2	172.5	94.3	184.0	95.2	256.0	96.1	398.0

The columns headed "loss" give the loss in B.T.U. per lineal foot of pipe at the temperature difference indicated, per hour. All data from tests conducted at Mellon Institute of Industrial Research.

CONSTRUCTION OF AIR CONDITIONING HOUSINGS USING CAREY "FIREFOIL" PANELS ERECTED IN "T" IRON FRAMEWORK

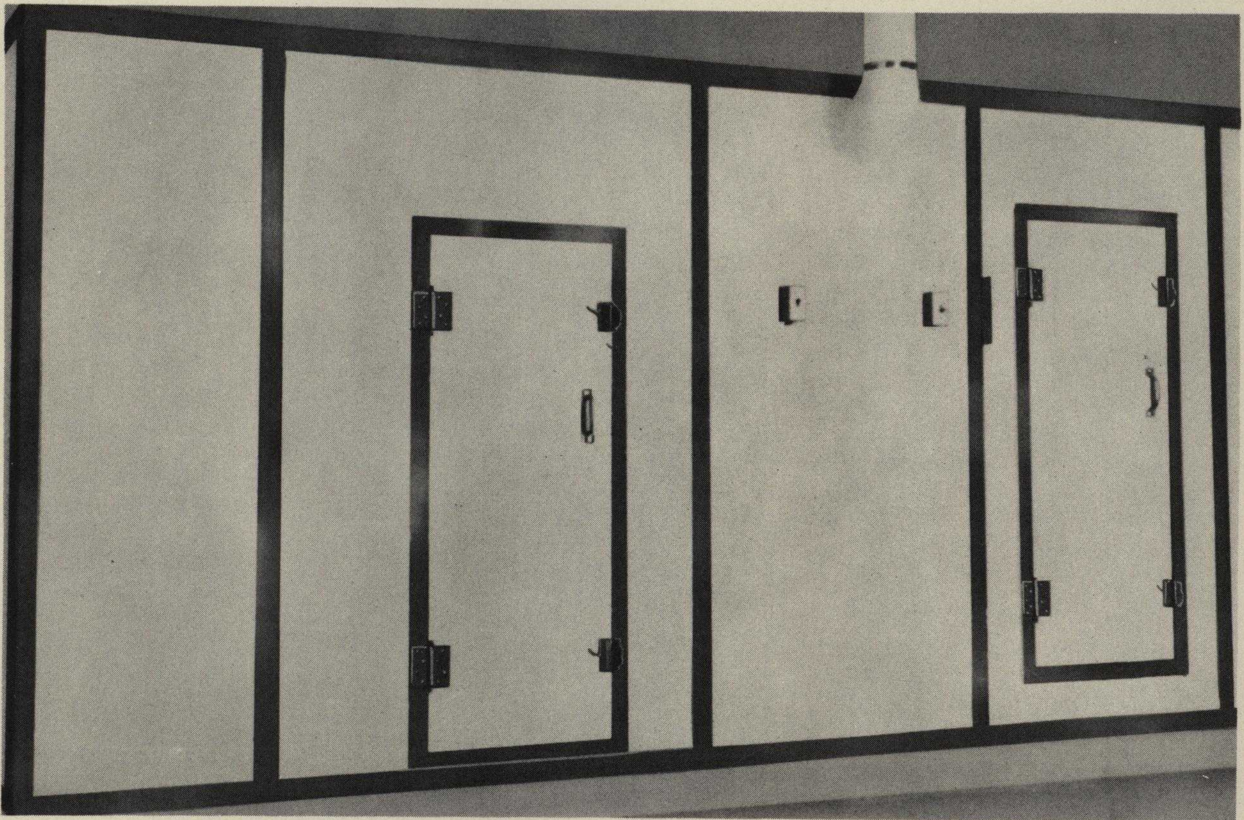
Carey "FIREFOIL" is the basic material from which "FIREFOIL" PANELS are constructed. "FIREFOIL" forms the core of these panels. It is composed of fine corrugated asbestos felts (approx. 8 ply per inch thickness) firmly bonded and treated to form a hard, strong, light weight, rigid, fireproof, and waterproof insulating board.



CAREY "FIREFOIL" PANEL

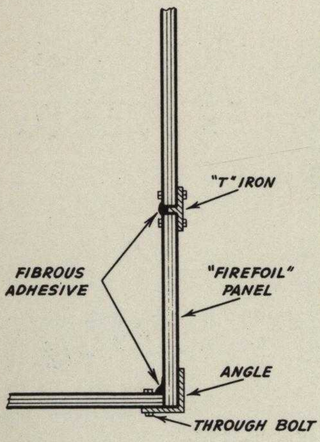
"FIREFOIL" PANELS are composed of "FIREFOIL" (which is the core) surfaced on both sides with Careystone Cement Asbestos Sheathing or Carey Wallboard. The thickness of Sheathing or Wall Board is usually 1/8 inch.

Firefoil Panels weigh approximately $3\frac{1}{4}$ to $3\frac{1}{2}$ lbs. per square foot 1 inch thick; maximum size is 48" x 96";-- thickness from $\frac{1}{2}$" up. Firefoil Panel is a unique insulation material that comprises characteristics of structural materials.



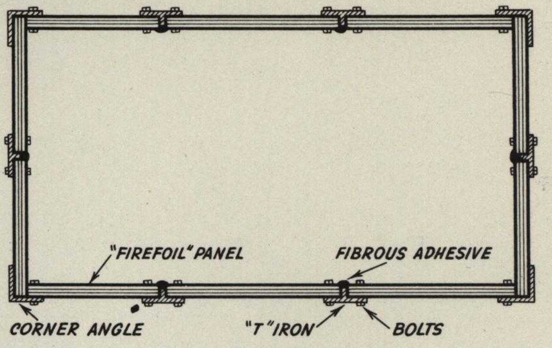
Air Conditioning Housing Constructed of Carey "FIREFOIL" Panels.

AIR CONDITIONING HOUSINGS



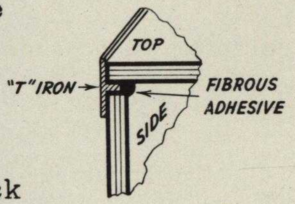
Corner Detail

For the construction of Air-Conditioning Housings a steel frame work, consisting of "T" irons or other structural shapes spaced in accordance with plans and specifications, is required as shown in the following sketches.

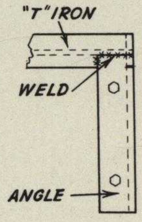


Section Through Housing Plan

The framework may be placed on a concrete base or other suitable location. After the framework is in place insert Carey "FIREFOIL" Panels (composed of Firefoil core of thickness sufficient to provide the required insulation characteristics, and surfaced on both sides with 1/8" thick Asbestos Cement Sheathing or Wall Board). Panels should be erected in "T" iron as shown in sketches.



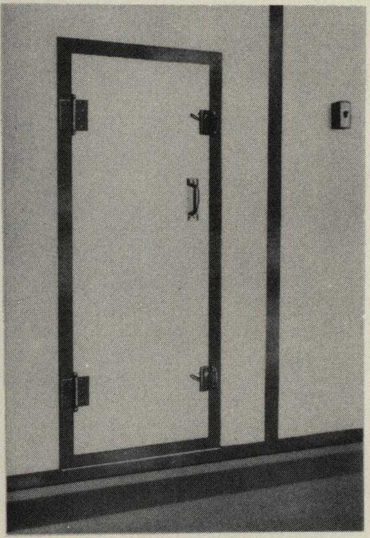
Vertical Section Showing Top.

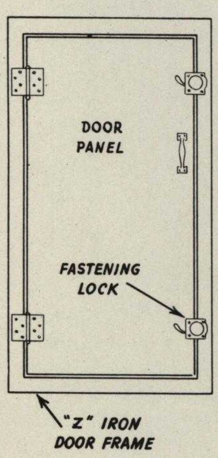


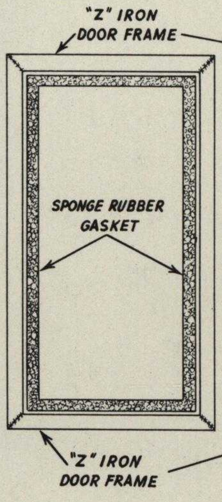
Top Corner Frame Detail

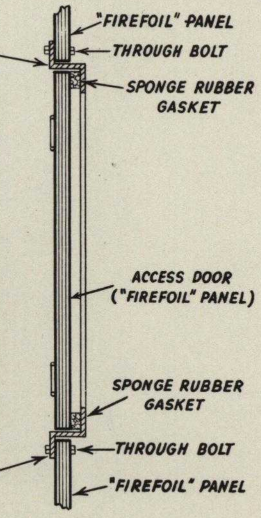
All Panels should be sealed tight against leakage with Carey Fibrous Adhesive. Panels must be held in framework by bolts of sufficient length to go through Panels and "T" iron.

All Access Doors to be made of same materials as the Housings. The Doors are to be fitted into a Door Frame built up of "Z" irons with suitable hinges and fasteners. Doors must be sealed against leakage with sponge rubber or other type of gasket cemented against flat face of "Z" irons as shown in sketch.









CAREYCEL ASBESTOS DUCT INSULATION FOR AIR CONDITIONING SYSTEMS

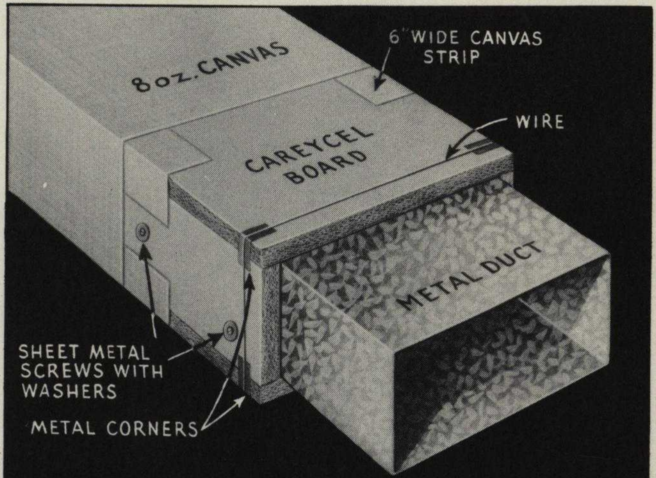
FIREPROOF **HIGH EFFICIENCY** **LOW COST**

Perhaps the most important requirement of duct insulation is that it be fireproof. With this must be combined high insulating efficiency, low cost, light weight, large area units to minimize joints, and easy workability to reduce labor costs.

CAREYCEL was designed to include, and does include all these characteristics. It most nearly satisfies all the requirements of ideal duct insulation -- made of everlasting Asbestos -- no rot or decay -- will not harbor vermin -- will not burn.

CAREYCEL asbestos insulation is composed of laminations (12 to 14 per inch of thickness) of sheet asbestos. The composition of the sheet, the process of "cellizing" it, and the methods of constructing the finished product are entirely different from those used for ordinary air cell (corrugated) types of coverings. The results are unusually low thermal conductivity (30% less heat loss than air cell), trim, smooth outer surface, and negligible shrinkage (approximately 0.05%).

CAREYCEL can be supplied for duct insulation in standard size sheets 36" x 36" or 72" or standard blocks 6" x 36". Any thickness is available from 1/4" up. Weight is approximately 1-1/2 lbs. per sq. ft. 1" thick. CAREYCEL sheets and blocks are packed for shipment in cartons or wood crates



Careycel board insulation applied to metal duct with sheet metal screws and washers, or wired in place using metal corners.

METAL DUCT INSULATION

CAREYCEL ASBESTOS DUCT INSULATION FOR AIR CONDITIONING SYSTEMS

FIREPROOF **HIGH EFFICIENCY** **LOW COST**

SPECIFICATIONS

Cover all ducts with 1/2" (see note) thick CAREYCEL Board, firmly wired in place, or attached to duct with sheet metal screws and tin caps. If CAREYCEL is wired in place use small sections of sheet metal angles under wire loops to prevent wire cutting into insulation at its edges. When metal screws and tin caps are used countersink caps into insulation and point up all holes and joints with asbestos cement to produce a smooth, even contour. Cover all cracks and joints with 3" wide, 10-lb. Asbestos Paper Tape, smoothly pasted on. Where duct work is exposed, apply 6" wide 8 oz. canvas strips to smooth and protect square edges of insulation. Cover the entire exposed surface of insulation with 8 oz. canvas neatly pasted on, and size and finish with lead and oil paint of color desired.

NOTE: ½" thickness CAREYCEL insulation is ample for the majority of installations. It will take care of conditions up to 25°F. temperature difference between air in the duct and the outside air and a relative humidity up to 75%, or it will take care of a condition involving a temperature difference of 30°F, between the temperature of the air inside the duct and the temperature of the room with a relative humidity up to 70%.

For severe humidity conditions, such as where a duct passes through a laundry room or a kitchen or where other heated equipment is giving off vapor, the thickness of CAREYCEL should be selected from the table below in accordance with the worst conditions of relative humidity and temperature difference. This table is based upon accurate determinations at the Mellon Institute, University of Pittsburgh, and all thicknesses specified incorporate a factor of safety of approximately 20% over and above thickness actually required to prevent condensation of moisture on the insulation surface.

Coarse cellular insulations are not desirable for duct insulation work, but, if used, then 40% greater thickness than that specified for CAREYCEL will be required to secure the same results.

THICKNESS OF CAREYCEL TO PREVENT SWEATING

Per Cent Relative Humidity	Difference in Temperature Between Room and Air Inside Duct						
	20°F.	25°F.	30°F.	35°F.	40°F.	45°F.	50°F.
60%......	1/4"	1/4"	1/2"	1/2"	1/2"	3/4"	3/4"
70%......	1/2"	1/2"	3/4"	3/4"	3/4"	1"	1"
80%......	3/4"	3/4"	1"	1-1/4"	1-1/2"	1-1/2"	1-3/4"
90%......	1-1/2"	2"	2-1/4"	2-3/4"	3"	3-1/2"	4"

Unless cold air ducts are very long, the proper thickness of insulation to prevent surface sweating will also give adequate insulation to prevent appreciable increase of temperature of the cool air.